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CONTRACTORS' & ENGINEERS' MONTHLY



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Where to Purchase

A comprehensive Directory of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may desire to secure catalogs or prices on construction equipment. Where the name of a manufacturer is preceded by a star (*) it indicates that the user of the directory may secure further information by referring to the manufacturer's advertisement in this issue. The index to advertisers will be found on page facing the inside back cover.

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- Columbus McKinnon Chain Co., Columbus, O.
- Link-Belt Co., Philadelphia, Pa.
- Spindel, J. G., Reading, Pa.
- Topping Brothers, New York.
- Upson-Walton Co., Cleveland, O.
- U. S. Chain & Forge Co., Pittsburgh, Pa.

CHAINS, STEEL AND MALLEABLE

- Chain Belt Co., Milwaukee, Wis.
- Jeffrey Mfg. Co., Columbus, O.
- Link-Belt Co., Chicago, Ill.
- Webster Mfg. Co., Chicago, Ill.

CHECK VALVES

- *Columbian Iron Works, Chattanooga, Tenn.
- *Ludlow Valve Mfg. Co., Troy, N. Y.
- *Mueller Mfg. Co., H. Decatur, Ill.
- Lunkenheimer Co., Cincinnati, O.

CHEMICALS FOR WATER PURIFICATION

- *Du Pont de Nemours & Co., E. I., Wilmington, Del.
- *Electro Bleaching Gas Co., New York.
- *Hooker Electrochemical Co., New York.
- *Matheson Alkali Works, Inc., N. Y. C.
- *Penns. Salt Mfg. Co., Philadelphia, Pa.
- General Chemical Co., New York.

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- Heine Chimney Co., Chicago, Ill.
- Rust Engineering Co., Pittsburgh, Pa.
- Weber Chimney Co., Chicago, Ill.

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- Rust Engineering Co., Pittsburgh, Pa.
- Weber Chimney Co., Chicago, Ill.

CHIMNEYS, STEEL (See Stacks, Steel)

CHLORINATORS

- *Wallace & Tiernan Co., Inc., New York.

CHLORINE, LIQUID (See Liquid Chlorine)

CHUTES, CONCRETE

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- Insley Mfg. Co., Indianapolis, Ind.
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CLIPS, WIRE ROPE

- American Steel & Wire Co., Chicago, Ill.
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- Broderick & Bascom Rope Co., St. Louis, Mo.
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- Roebeling Sons Co., J. A., Trenton, N. J.
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- Chain Belt Co., Milwaukee, Wis.
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- Gifford-Wood Co., Hudson, N. Y.
- Hayward Co., New York.
- Hunt Co., Inc., C. W., West New Brighton, N. Y.
- Jeffrey Mfg. Co., Columbus, O.
- Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
- Lidgerwood Mfg. Co., New York.
- Link-Belt Co., Chicago, Ill.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- Portable Machinery Co., Passaic, N. J.
- Robins Conveying Belt Co., New York.
- Toledo Bridge & Crane Co., Toledo, O.
- Webster Mfg. Co., Chicago, Ill.

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- *Union Water Meter Co., Worcester, Mass.
- Chapman Valve Mfg. Co., Indian Orchard, Mass.
- Glanher Brass Mfg. Co., Cleveland, O.
- Haydenville Co., Haydenville, Mass.

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- Blaw-Knox Co., Pittsburgh, Pa.
- Hydraulic Steelcraft Co., Cleveland, O.
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- Universal Form Clamp Co., Chicago, Ill.

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CONCRETE FLOOR HARDENER

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- Granitex Corp., New York.
- Horn Co., A. C., Long Island City, N. Y.
- Master Builders Co., Cleveland, O.
- Sonneborn Sons, Inc., L. N. Y. "Lapidolith"

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- *Koehring Machine Co., Milwaukee, Wis.
- *Ransome Concrete Machy. Co., Dunellen, N. J.
- *Standard Scale & Supply Co., Pittsburgh, Pa.
- *Worthington Pump & Mch. Corp., N. Y. C.
- American Cement Machine Co., Keokuk, Ia.
- Atlas Engineering Co., Milwaukee, Wis.
- Chain Belt Co., Milwaukee, Wis.
- Contractors' Equipment Co., Keokuk, Ia.
- Foot Concrete Mch. Co., Chicago, Ill.
- Gray Iron Fdry. Co., Reading, Pa.
- Judy Mfg. Co., Centerville, Ia.
- Knickerbocker Co., Jackson, Mich.
- Lakewood Engineering Co., Cleveland, O.
- Lansing Co., Lansing, Mich.
- Oshkosh Mfg. Co., Oshkosh, Wis.
- Schramm & Son, Inc., Chris. D., Philadelphia, Pa.
- Smith Co., T. L., Milwaukee, Wis.
- Waterloo Const. Mach. Co., Waterloo, Ia.

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- *American Steel & Wire Co., Chicago, Ill.
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- *Truscon Steel Co., Youngstown, O.
- Brown Hoisting Mch. Co., Cleveland, O.
- Carnegie Steel Co., Pittsburgh, Pa.
- Concrete Steel Co., New York.
- Corrugated Bar Co., Inc., Buffalo, N. Y.
- Electric Welding Co., Pittsburgh, Pa.
- General Fireproofing Co., Youngstown, O.
- Inland Steel Co., Chicago, Ill.
- Lackawanna Steel Co., Buffalo, N. Y.
- Robertson Co., H. H., Pittsburgh, Pa.
- Ryerson & Son, J. T., Chicago, Ill.
- Wickwire Spencer Steel Corp., Worcester, Mass.

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- *Worthington Pump & Mch. Corp., New York.
- Cameron Steam Pump Works, A. S., New York.
- Dean Bros. Steam Pump Wks., Indianapolis, Ind.
- Ingersoll-Rand Co., New York.
- Wheeler Condenser & Eng. Co., Carteret, N. J.

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- *Turbine Sewer Machine Co., Milwaukee, Wis.
- *Waldo Bros. & Bond Co., Boston, Mass.

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- Fibre Conduit Co., Orangeburg, N. Y.
- Johns-Manville Co., H. W., New York City.
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- Youngstown Sheet & Tube Co., Youngstown, O.

CONTRACTORS' SUPPLIES, DEALERS

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- Shannon & Co., J. Jacob, Philadelphia, Pa.

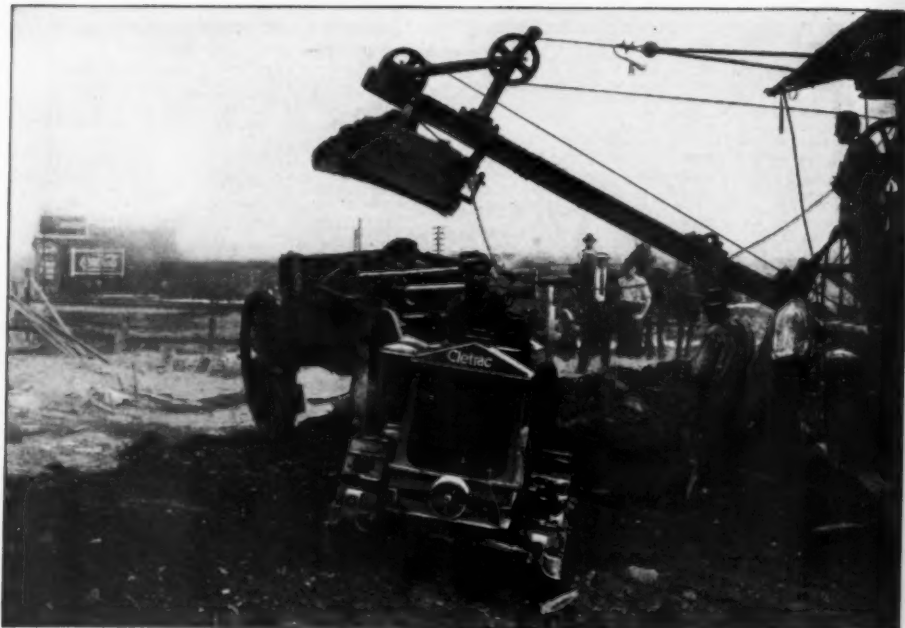
CONTRACTORS' USED EQUIPMENT

- *Craven Co., Frank T., New York.
- *King, Philip T., New York, N. Y.
- *Titan Equipment Co., New York, N. Y.
- *Zelmick Supply Co., Walter A., St. Louis, Mo.
- Contractors' Mach. & Supply Co., Pittsburgh, Pa.

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Cletrac Hauls a Double Load

— a third faster than teams

SPECIFICATIONS

Horsepower:
12 at drawbar,
20 at belt-pulley
Length: 96 inches
Width: 50 inches
Height: 52 inches
Weight: 3455 pounds
Turning Circle: 12 feet
Traction Surface:
About 800 square inches
Center to Center of Tracks:
38 inches
Belt Pulley: Diameter 8
inches, face 6 inches

THE CLETRAC is hauling a standard dump wagon equipped with additional side boards.

It carries twice the ordinary load handled by a team of horses. And Cletrac makes the haul easily and about a third faster.

Cletrac's ability to work regardless of ground or weather conditions makes it a great favorite among engineers and contractors.

See the Cletrac dealer near you *now*. Or write to us for detailed information about the tank-type Cletrac.

Cletrac
TANK-TYPE
TRACTOR

THE CLEVELAND TRACTOR CO.

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- Toledo Bridge & Crane Co., Toledo, O.
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- Whiting Corp'n., Harvey, Ill.

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- Archer Iron Works, Chicago, Ill.
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- Osgood Co., The, Marion, O.
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- Ingersoll-Rand Co., New York.
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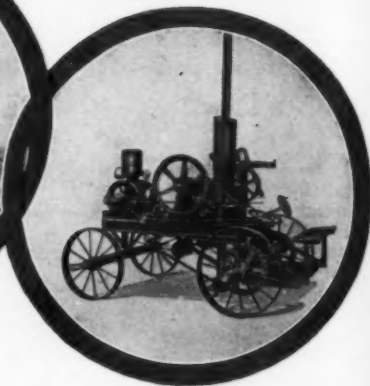
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**WHEEL TYPE
P&H
EXCAVATOR**



**POWER TRACTION
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**POWER TRACTION
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The purchase of a P & H Trenching Unit is a terse answer to the question of city trenching.

On city streets where work must be done with uniformity, and dispatch, the P & H combination—Excavator, Backfiller, and Tamper—is the logical equipment for the job.

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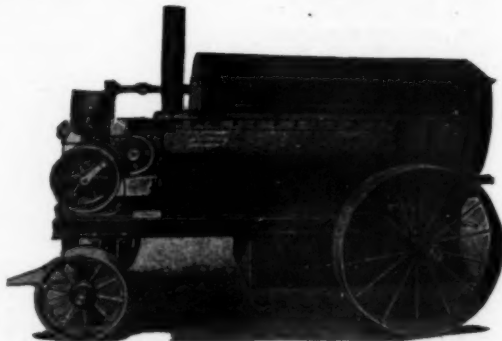


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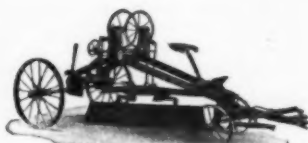
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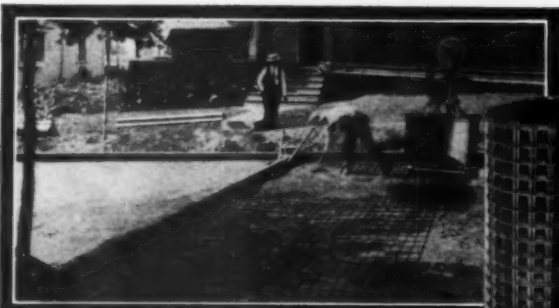
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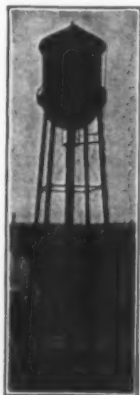
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*Webster Mfg. Co., Chicago, Ill.
*Wickwire Spencer Steel Corp., Worcester, Mass.

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*Chain Belt Co., Milwaukee, Wis.

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Clark Bros. Bolt Co., Milldale, Conn.
St. Louis Screw Co., St. Louis, Mo.

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*Craven Co., Frank T., New York.
*King, Philip T., New York, N. Y.
*Titan Equipment Co., New York N. Y.
*Zelnicker Supply Co., Walter A., St. Louis, Mo.

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*Pacific Flush Tank Co., Chicago, Ill.

SEWAGE PUMPS AND EJECTORS

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*Pacific Flush Tank Co., Chicago, Ill.
*Yeoman Bros. Co., Chicago, Ill.
*Erie Pump & Eng. Works, Medina, N. Y.
*Walworth Mfg. Co., Boston, Mass.

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Denver Sewer Pipe & Clay Co., Denver, Col.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Macomb Sewer Pipe Wks., Macomb, Ill.
McNutt Meter Box Co., Brazil, Ind.
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*Healey, P. J., New York.
*Thompson-Fleming Co., Inc., Buffalo, N. Y.
*Turbine Sewer Machine Co., Milwaukee, Wis.

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*Delaware Clay Products Co., Pittsburgh, Pa.
*American Vit. Products Co., Akron, O.
*Blackmer & Post Pipe Co., St. Louis, Mo.
*Denver Sewer Pipe & Clay Co., Denver, Col.
*National Fireproofing Co., Pittsburgh, Pa.
*Robinson Clay Product Co., Akron, O.

SEWER RODS

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*Champion Corp., Hammond, Ind.
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*Thew Shovel Co., Lorain, O.
*Marion Steam Shovel Co., Marion, O.

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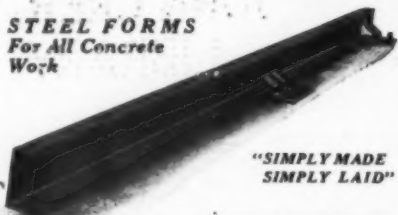
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For All Concrete
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HELTZEL steel forms should be used on all your road jobs because they are so easily set up and taken apart. They are strong as only steel can be and stand up admirably under the finishing machine. Heltzel steel forms enable you to build roads, sidewalks and gutters in record time. They last several seasons and have proven their superiority over all other forms. Hundreds of contractors are using Heltzel steel forms with unbounded satisfaction and a big saving in time and money and labor. Send us your name for illustrated material—no obligation.

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It softens asphalt and other bituminous pavements so that any part can be easily removed, and new material added. It vulcanizes the old and new material into a perfect weld. It makes resurfacing and main-



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Can be adjusted to any width from eight to sixteen feet and any depth. It can also be adjusted to provide a crown for the road.

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Write for complete information.

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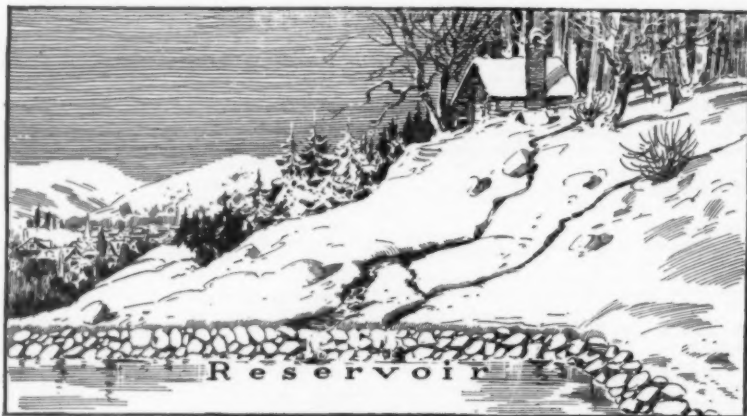
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Produced from a rubber-like compound. Tough, pliable, adhesive and little affected by heat or cold. Repair your concrete cracks with it.

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Melting Snow Brought the Scourge of Typhoid

It happened in Plymouth, Pa., in 1885, and it has happened many times since and it may happen in your town this Spring.

Plymouth received her water supply from reservoirs on the surrounding watershed. On this elevation were a few cabins in one of which was a man suffering from typhoid. The wastes from this cabin were thrown out onto the snow.

And then a few weeks later the snow melted and the refuse was washed down into the reservoirs.

An epidemic of over a thousand typhoid cases raged. The cause was directly traceable to the one case on the watershed.

"W. & T." apparatus for sterilizing water by the application of Liquid Chlorine, is now making a recurrence of this pestilence impossible. But how about your community? Is it properly safeguarded with every precaution against such a tragedy?

Do you realize that once each week some American Community is visited by the scourge of Water-borne disease—which is stopped by sterilizing the water—but which could have been prevented had "W. & T." apparatus been installed in time?

Our booklet on the "Water Supplies of Small Communities" is very interesting. Won't you ask us to send you a copy of it?

WALLACE & TIERNAN CO., Inc.

NEWARK, NEW JERSEY

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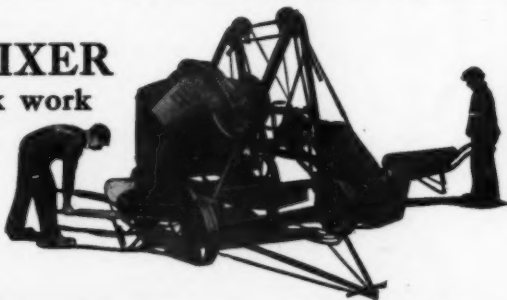
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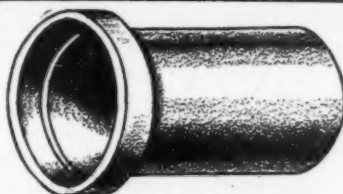
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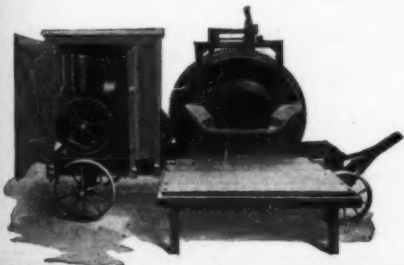
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Contractors' & Engineers' Monthly

New York

February, 1921

Why Contractors Should Carry Insurance— State Liability Laws Vary

By R. R. Rawle

The Rockwood-Badgerow Company, Chicago, Ill.

ALL contractors assume considerable responsibility in cases of accidents on the job, as is shown particularly in the accident experience record covering building construction. These may occur to the men in the contractors' employ or to other people who come to the job. Compensation and liability insurance is provided by all the leading insurance companies to cover the entire responsibility of the contractor. Full coverage of this kind is very essential; in fact, there is no contract previous to starting work which is more important than that of insurance.

There are all kinds of insurance contracts—varying degrees of merit and demerit. Insurance is the last thing in the world with which to experiment. Therefore the contractor should select the insurance company with the same degree of interest and care that he exercises in selecting his bank.

The compensation laws which exist in a number of states cover certain stipulated schedules of pay for loss of time, medical expense, dismemberment, disfigurement, and loss of life, accidentally suffered by employees, and for pensions in the event of permanent total disability.

The acceptance of the provisions of the compensation law of various states in which the employer has the privilege of choice seems to be advisable, as it appears to be a fair and equitable means of settlement. The employe knows exactly what the law provides for him, and cases in dispute are comparatively few.

Wherever any dispute arises, both the employer and the employe have the privilege of submitting the case to an industrial accident board, such a body being provided by each of the states in which the compensation law is in effect, and to which litigants may appeal without any outlay for its services.

Another advantage, of course, is that court proceedings are unnecessary. The benefit of this feature in the law is obvious, eliminating considerable loss of time usually entailed in trial proceedings, and precluding the frequently expensive services of attorneys.

Insurance for Liability in Other States

Employers' liability insurance is written to relieve the employer of loss for accidental injury to employees in states in which compensation laws do not exist. This form of coverage is available under contracts of insurance stipulating certain limits beyond which the insurance company is not liable. The limits under this form are generally as follows: \$5,000 for one person injured, and, subject to that limit for each person, the company's liability on account of any one accident injuring more than one person is limited to \$10,000. However, higher limits can be provided for a small increase in premium. These higher limits should be carried on most classes of building construction.

Compensation and employers' liability insurance contracts are generally written to cover all the contractor's operations wher-

ever undertaken, the period of coverage being one year.

"Rates per \$100 of wages" is the basis of premium charge, the pay-roll being the only fair means of measuring the cost for the hazard involved. An estimate of pay-roll is used as the basis for computing the advance premiums. The actual premium is ascertained by audit of the pay-rolls at expiration of the policy term, the earned premium for the year being the amount derived by the application of rate to the actual pay-rolls.

Frequently where pay-rolls are large, involving a premium upward of \$1,000 per annum, a 20 per cent deposit is paid in advance, and a quarterly or monthly audit and premium settlement is arranged, a deposit being carried over by the insurance company to apply on the last audited period under the contract. This method of premium payment is effective on all forms of compensation and employers' liability contracts of insurance.

Public Liability Insurance

Public liability insurance is equal in importance to insurance covering those in the employ of the contractor. Accidents may occur within, adjacent to, and in the vicinity of building in the course of construction, to persons having no interest in the operations conducted by the contractor. While such accidents occur with less frequency than do accidents to workmen, they are usually costly and decidedly more difficult to adjust. Claims are made and suits instituted which are very often purely the fabric of unprincipled persons and unscrupulous lawyers. Those of the legal profession known as "ambulance chasers" no longer pursue the injured workman in an endeavor to make out a case for him, as the administration of the compensation law obviates such procedure. The result is that the shyster lawyer has doubled his efforts in prosecuting claims for injuries to the public.

Careful handling by experienced adjusters is absolutely necessary in disposing of claims of this character. Most of the leading insurance companies are well equipped to cope with such situations, and the up-to-date businesslike contractor carries a policy of public liability insurance together with an employer's form, so that accidents from either source can be reported to the insurance claim division and the contractor re-

lieved of all anxiety and perhaps some business embarrassment.

This form of insurance is written under contracts bearing limits of \$5,000 for one person injured, \$10,000 for one accident, effective in the same manner as previously outlined under the employer's liability form. A great many of the contractors to-day are carrying higher limits, usually \$10,000 and \$20,000, and very often \$10,000 and \$50,000, where the work engaged in seems to warrant more coverage.

Public liability insurance, which also is based on pay-roll and subject to audit, is less costly than the two other forms of coverage, the rate usually ranging from 15 to 25 per cent of the rates charged under the employers' liability policy.

This insurance demands the selection of an insurance company of the highest grade, as some of these public cases are in process of litigation for years. Then, also, there are cases which if poorly handled might permit of a claim going beyond the company's limit of liability, the excess, of course, falling upon the insured.

Qualifications of an Insurance Company

In selecting an insurance company it should be remembered that the legal liability of an employer rests with him and that his contract of insurance is purely and simply his own personal arrangement, and that failure on the part of the insurance company in nowise relieves him. Therefore, the insurance company should be chosen with particular care.

The insurance company must be equipped with a claim department capable of rendering prompt and efficient service. This is necessary because under the laws of various states there are rules and regulations imposing penalties and fines for non-compliance with such requirements.

The experience which an insurance company has had is very important, because much depends upon the intelligent handling of all matters regarding relationship between employer and employee. Loose and slipshod methods cause untold injury.

Last, but decidedly not least in importance, the contractor should designate an agency or office of good repute, whose experience in this line makes it possible to know what the contractor's insurance requirements may be. Such person or office should be constituted by the contractor as

his personal representative, to procure for him policies of insurance which will provide full and adequate coverage, and to serve the best interests of the contractor at all times.

A Final Word

The best insurance is the cheapest in the

long run.

Coöperation at all times for the reduction of accidents is important, for upon renewal of the insurance the insured's experience is a factor in the application of rate.

ACKNOWLEDGMENT.—From an article published in *Contractor's Atlas*.

New Speed Truck for Contractors

A NEW speed truck of $\frac{3}{4}$ - to 1-ton capacity, known as Model 15, has just been announced by the Service Motor Truck Company, Wabash, Ind. This truck is the result of over four years' development work, excluding the time when the factories were taken over by the United States Government.

Experimental models of this truck were used during the war as utility trucks about the plant, thus giving them severe usage and providing valuable data when development again proceeded in the spring of 1919. The principles of scientific cushioning are developed to a very high degree, and a unique front spring suspension is included. At the front end of the truck a semi-elliptic spring is mounted crosswise, the ends being carried on the axle and the center supporting the frame. This spring is pivoted on its center point so that the front axle is perfectly free to move about the pivot.

The entire truck with this construction is carried on the 3-point support which cushions the body, hood, radiator and steering mechanism against strains and twisting.

At the same time a great deal of the twisting and racking strain is taken off of the springs.

The experimental run of this truck included a trip of about 1,200 miles under the supervision of engineers from the factory, which took the trucks into the states of Indiana, Ohio,

Pennsylvania and West Virginia under very severe operating conditions. For three days the drivers went through snow from 8 to 12 inches deep, and 400 miles of the trip was in the Allegheny Mountains and foothills, part of the going being over very bad mud roads.



AN ILLUSTRATION OF THE ADVANTAGES OF THE NEW SERVICE PIVOTED, SEMI-ELLIPTIC SPRING ON THE FRONT AXLE

Are You Using Machinery to Save Money?

In most construction work in the United States, the day of the man and the pick and shovel is past. The transition from "the gang" to "the machine" has been very rapid. The change has been wrought by the need of quantity production whether it be in digging a trench or in building a bridge. Contractors have realized the savings and have adopted the machine almost universally.

A New Practical Road Planer

A NEW practical machine for highway maintenance has been invented by Richard A. Jones, for many years Street Commissioner of Waltham, Mass., as a result of his experience and knowledge of the conditions and requirements of modern road construction and maintenance. The Kinney Manufacturing Company, 3529 Washington Street, Boston, Mass., has acquired full rights for the manufacture and sale of this equipment, which is to be known as the Kinney Road Planer, Jones' Patent.

The road planer is especially designed for use on bituminous roads and highways. It is adapted for planing or leveling the waves or ridgy elevations which frequently appear on the road surface. The machine is a combination drag, planer and scarifier. It is constructed entirely of metal and weighs about $3\frac{1}{2}$ tons. It may be drawn by a steam roller or tractor, and the machine is mounted on steel runners. The runners are equipped with removable cast iron shoes, which are of ample length to cover or cross the road waves without following the contour of the surface. Upon the runners is mounted an oscillating iron plate, holding the planer knives and scarifying chisels or picks, all adapted for adjustment by hand-operating screws to meet the varying conditions of the road surface, or according to the kind of bituminous material of which the road is constructed. The entire equipment may be raised or lowered at will or adjusted for planing as required. For moving the machine to a distance or from one job to another, steel wheels are provided, equipped with lifting screws, by

means of which the entire machine may be raised and balanced upon the wheels for transportation. When in actual service, the machine is lowered and moved upon the runners. It has a double equipment of picks or planer knives, and may be drawn backwards or forwards without being turned upon the runners.

By the use of this machine the bunches or ridgy elevations can be removed from the road surface without destroying the general contour of the road. The facilities for adjustment of the scarifiers and planers in any desired angularity or depth of cut enable the operator to meet the different conditions arising from changing temperatures or varying viscosities of the material used in the construction of the road. In operation the scarified ridges of the road are smoothed and leveled by the planer knives, and after proper sealing and rolling of the leveled portions, the road may be opened to traffic. If conditions require, the entire surface may be treated with a new seal-coat application of bituminous material, with the necessary covering. While designed especially for use on bituminous surfaces, the planer may also be used to good advantage on macadamized or dirt roads.

In the New Hampshire State Highway Department, where this machine has been thoroughly tested under severe conditions, it has been shown that by the use of one machine during the past season a saving of many thousands of dollars has been effected as compared with the expenditures involved in the usual method of reconstruction and renewal of road surfaces.



ONE OF THE KINNEY ROAD PLANES IN ACTION

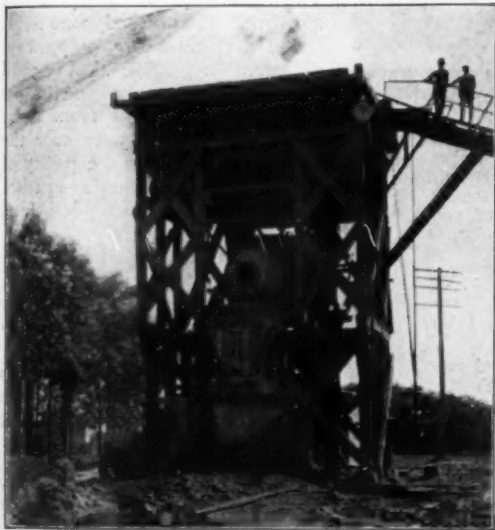
Central Mixing Plant Establishes Paving Record*

WHERE conditions warrant the use of a central mixing plant for paving work, it has usually been contended that this method is exceptionally speedy. It is interesting to note, therefore, that a new world's record for a single day's production has been established by McCree, Moos & Company, St. Paul, highway contractors, using a one-yard Smith tilting mixer operated as a central mixing plant.

The total yardage laid by the central mixing plant in ten hours was 355 cubic yards, the record day's production being 912 lineal feet of 18-foot road, average thick-



THE LEE END-DUMP BODIES DISCHARGE QUICKLY AND COMPLETELY



TRUCK WITH LEE BODY READY FOR A LOAD OF MIXED CONCRETE AT CENTRAL MIXING PLANT

ness 7 inches. The world's record in using the paving mixer method, as established by Alan Jay Parrish at Paris, Ill., was 308 cubic yards, the record production for 10 hours being 779 lineal feet of 8-inch, 16-foot road.

* Since the preparation of this story, word has been received that the record has actually been boosted by the same plant to 1,094 lineal feet in 8 hours, or 748 square yards of 7-inch concrete.

According to these records, the central mixing plant method produced over 15 per cent more road than the paving mixer method. State specifications on both jobs required a full-minute mix per batch.

The details contributing to this 912-foot record are worthy of careful study. The McCree-Moos contract covers $7\frac{1}{2}$ miles of road running north and south from Big Lake, Minn. The central mixing plant was located in Big Lake at the half-way point of this road, so that the maximum haul for the mixed concrete to either extremity of the road was $3\frac{3}{4}$ miles.

It is an 18-foot highway, one-course concrete pavement, $6\frac{1}{2}$ inches thick on the sides and $7\frac{1}{2}$ inches thick in the center, the average thickness being termed 7 inches. A 1:2:4 mix was used, as allowed by the state of Minnesota when a machine tamper and finisher is used. The state specifications on "composition" are as follows:

lows:

"This concrete shall be composed of 1 part Portland cement, 2 parts fine aggregate, and $3\frac{1}{2}$ parts of coarse aggregate, unless the machine tamper and finisher is used, in which case 4 parts of coarse aggregate may be used."

The state's clause specifying "consistency" reads as follows:

"Sufficient water shall be used in mixing to produce a concrete which will meet with the



SMITH TILTING MIXER DISCHARGING INTO TRUCK
WITH ORDINARY DUMP BODY AT CENTRAL PLANT

following test: When placed and tamped in a cylinder 6 inches in diameter and 12 inches high and the form removed, the concrete shall have a vertical settlement of not more than 2 inches when machine finishing is employed, and not more than 6 inches when hand finishing is employed."

The dry mix was necessary, therefore, on this job, and the central mixing plant proved its practicability thoroughly, even with this mix.

"Concrete shall be mixed to designated consistency in a batch concrete mixer of the approved type until the cement is uniformly distributed and the concrete is homogeneous and uniform in color. Each batch shall remain in the mixer at least one minute and have not less than 12 nor more than 18 full turns of the mixing drum. The mixers shall be equipped with a timing device. Retempering or remixing concrete that is partially hardened will not be permitted."

A full-minute mix was strictly adhered to. McCree, Moos & Company had a batch meter of their own make on this mixer, which merely rang a bell at the end of the required number of revolutions of the drum, but which did not register these revolutions. The State Highway Engineer permitted them to use this batch meter instead of the one furnished.

Handling the Materials

The handling of materials at the central mixing plant is efficiently and simply arranged. The cement, in bags, is unloaded direct from the cars into a warehouse at the plant. A belt conveyor leads from the warehouse to a hopper directly over the mixer. The bags are opened in the warehouse, and the cement, six bags at a time—enough for one batch—is dumped upon the belt conveyor which carries it up to the cement hopper.

The sand is brought from a pit, $1\frac{3}{4}$ miles away, to the central mixing plant, by $2\frac{1}{4}$ -ton end-dump trucks. The trucks deposit the sand in a trap, from which another belt conveyor elevates it to a second hopper over the mixer. This sand hopper has a capacity of 20 yards. The crushed stone is St. Cloud granite and is shipped to the plant in gondolas. A 1-yard clam-shell bucket on an 85-foot boom derrick unloads from these

cars directly into a third hopper over the mixer. The stone hopper has a capacity of 25 yards. When filled, the surplus crushed stone is unloaded into the stock pile behind the derrick.

The batch hopper of the mixer is subdivided to hold the correct proportions of cement, sand and crushed stone, which are fed into the batch hopper from the respective material hoppers directly above it.

After the 1-minute mix, the mixer tilts and discharges its entire batch in 8 seconds into a bottom-dump hopper arranged just



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CURING THE CONCRETE ROAD

high enough to permit the trucks to drive in beneath it. This hopper for the mixed concrete will hold two full batches, 2 cubic yards.

The wet concrete is carried to the road by motor trucks of 2-1/2-ton capacity, with special short wheelbase, equipped with end-dump bodies manufactured by the Lee Trailer & Body Company, Chicago. These bodies have a level capacity of 2 yards, but are usually loaded with about 1-1/2 yards of concrete.

Speed of Work Dependent on Transportation Facilities

The first stretch of road laid on this contract was started a mile and a half north of the mixing plant, working south. When this section had been completed up to the mixing plant, the work was started a mile and a half south of the town of Big Lake, working north. When this 3-mile section was completed and ready for traffic, the work was started at the extreme northern extremity of the road, 3-3/4 miles from the mixing plant, working south again. This system enables the trucks to travel a mile and a half over the new concrete road with their loads of concrete, and continually cuts down the stretch that has to be traveled over the unpaved road.

One of the remarkable points about this job is that the 912-foot record is not at all indicative of the real capacity of this central mixing plant. The amount of pavement laid depended entirely upon the transportation facilities for the concrete. Not nearly enough trucks were equipped with the Lee bodies to work the plant to its full capacity.

More trucks are required, of course, when the haul is to the extremities of the road than when paving near the mixing plant.

For instance, on the first mile and a half, while paving not more than half a mile from the plant, with only four trucks they succeeded in laying 883 lineal feet in one day. Then, with seven trucks, paving the section at the furthest extremity of the road, they made their 912-foot record in one day. If they had had their complete fleet of twelve trucks available for this work, the record could have been far greater, as the mixing plant had to wait repeatedly for the trucks to handle the concrete.

The Mixer

On this job, McCree, Moos & Company have made the remarkable average daily record of 1,100 square yards, or 550 lineal feet, for several weeks on this 7-inch, 18 foot highway.

The history of the mixer used on this job is interesting. It is a second-hand mixer, sold originally by the T. L. Smith Co., Chicago, to A. Guthrie & Company, Blue Island, Ill., in 1916. It was used on the big project of the Calumet Sag Channel at Blue Island and was finally resold to McCree, Moos & Company after that job was completed. Originally it was equipped with an electric motor, but was resold without the motor. On the present job a motor is mounted near the ground, and the power is transmitted by a long belt to the mixer up on the scaffold. With the exception of this new motor, the mixer is just as it was originally in 1916, including the batch hopper and all.

The belt conveyors are also second-hand equipment, but the records of production prove that the work is being accomplished in a first-class manner.

Comparing the two methods of paving—the paving mixer method and the central mixing plant method—the total yardage speaks favorably for the central mixing plant. Considering, however, that the paving mixer had a 3/4-yard mixed concrete capacity and was working with a 1:2:3-1/2 batch instead of a 1:2:4 batch (shrinkage being somewhat more on the 1:2:3-1/2 mix), the percentage of increase of the central plant over the paving mixer is somewhat minimized. On the other hand, the central plant in this case was handicapped by insufficient transportation of its product.

The Nature and Control of Quicksand

Part II

By Charles R. Gow

Charles R. Gow Company, General Contractors, Boston, Mass.

The Compressed Air Process

IN sinking excavations to great depths through fine wet sand, or in those cases where the inflow of water is beyond the capacity of practical pumping operations, resort must be had to the pneumatic or compressed air process. The introduction of air into the workings of a shaft or caisson under a pressure equal to or greater than the hydrostatic pressure at the bottom, naturally forces the water back into the soil and permits access to it for the purpose of further excavation. The same fine sand which perhaps has previously boiled violently under the influence of inflowing water so as to be absolutely unstable and incapable of sustaining any weight, is often found under the pneumatic method to require picking for its removal. No better illustration than this could be had of the fact that it is the upward flow of water and not the material itself which results in a "quicksand" condition.

The use of the pneumatic process has been more or less common in the past for the sinking of deep supply wells. Cylinders either of steel or concrete are used as casings, and when such casings have penetrated a sufficient depth into porous material, removable plates covering numerous inlet openings around the circumference are detached, permitting an inflow of water from the coarse stratum.

Fine wet sand deposits which offer almost insurmountable difficulties in the case of open excavations may usually be tunneled with the utmost ease by the use of compressed air, because in removing the water the material becomes both dense and stable.

An Interesting Instance

A few years ago the writer had occasion to sink a concrete chimney foundation 20 feet in diameter to a depth of 40 feet through a bed of fine wet sand. After excavating to the ground-water level, forms were erected for the outer circumference of the foundation, and the first 10 feet in height of the foundation was erected. A working chamber was hollowed out in the

under portion, and a circular vertical shaft opening 6 feet in diameter was formed in the center. As soon as the concrete acquired its set, the outer forms were stripped and sinking was commenced by excavating from beneath the cutting edge, more concrete being added at the top as the foundation settled into the excavation thus made. When the sand began to give evidence of boiling or welling up, two steel lock heads with doors in them were built into the central shaft opening 6 feet apart vertically, and the space thus enclosed was used as an air lock. Air pressure was then applied to the working chamber, driving out the water in the sand and leaving an extremely compact material which required vigorous picking for its removal. As fast as the excavation could be carried down below the cutting edge, the air pressure was temporarily lowered, and the concrete mass slowly settled to the bottom. In this manner the bottom of the foundation was carried down to a clay hard-pan at a depth of 40 feet below the surface. The working chamber and central shaft were then filled with concrete, leaving a cylindrical monolith 20 feet in diameter, upon which the chimney was constructed.

The entire operation required six weeks for completion, and cost approximately \$12 per cubic yard, including all expenses of every description.

The writer has previously stated that the quicksand condition rarely occurs in nature. Stories of men and animals losing their lives by being "sucked" into quicksand beds probably have their origin in the mistaken application of the term to deposits of semi-fluid mud, silt or soft clay.

Undoubtedly there may occur isolated cases in which ground water rises to the surface through beds of fine sand, thus producing a natural quicksand, although the writer does not recall ever having seen this particular combination.

Applying a Remedy

Several years ago, however, the writer was called into consultation in connection

with an upheaval of fine sand and water in the basement of a mill building which ultimately resulted in serious damage to the structure. A test boring made at the site disclosed the fact that there existed a surface layer of very compact clay hard-pan overlying a bed of extremely fine sand about 20 feet in thickness. Immediately under the fine sand was a substantial layer of coarse gravel containing water under such a head that it rose in the boring pipe to a height 14 feet above the level of the basement floor, or several feet higher than the natural ground level in the vicinity. A large brick drain below the basement floor permitted the ready escape of the flowing sand onto a near-by beach.

In order to remedy the difficulty, several 6-inch pipes were driven down to the coarse stratum and their tops cut off just below the basement floor grade. The clear water flowed through the open pipes so freely that the ground-water head was thereby reduced below that required to force its passage upward through the fine sand, with the result that the flow of sand ceased entirely. Incidentally, a most excellent water-supply was secured to the mill for manufacturing purposes, but at the expense of rebuilding a considerable portion of the building, which was undermined before the remedy was applied.

It has been the writer's observation that fine wet sand in its normal condition will sustain quite as great a foundation load as will the coarse-grained sands. The usual aversion to using wet sand as a bearing material has its chief basis, in the writer's opinion, in the fact that we usually see such sand in its abnormal and not its normal state.

Some years ago the writer had occasion to construct some pier foundations upon coarse wet sand. The test borings indicated a firm layer of sand, but when the excavation had progressed to this point it was found by the inspector that he could readily force a rod into the soil for a considerable depth. Because of this apparent instability, he ordered that the excavation should be carried deeper until satisfactory material was encountered. The foreman suspended work for the time being and allowed the ground water to rise in the pit to its normal level. Upon attempting again to demonstrate the soft quality of sand by means of the same rod, the inspector was surprised to find that he

could make no impression upon the surface of the sand now that there was no longer an upward flow through it.

It is because of the fact that we are obliged ordinarily to produce an unnatural condition in wet sand in order to expose and examine it, that so many people assume this to be its natural state, while the contrary is in reality true.

The Bearing Values of Quicksand

A perusal of the building regulations of the several large cities will show that fine wet sand and "quicksand" are allowed bearing values of from $1/2$ to 2 tons, while coarse sands are allotted much higher values. It has been the experience of the writer in making tests upon the fine wet sands that they will carry quite as much load as the coarser sands, provided the ground water stands at its normal level.

The chief danger in using such materials for foundation loads lies in the possibility of future excavations being made in the immediate neighborhood which may be carried to a lower depth than that of the foundations referred to, in which case there may be a flow of surrounding soil toward the new opening, thus undermining the foundation. Such damage, however, will occur whatever may be the unit loading upon the soil.

The writer has never hesitated to recommend loadings as high as 4 tons per square foot upon sand which, during the excavation process, permitted the workmen to sink to their knees in it. Nor has there ever been to his knowledge any observable settlement in such cases.

A distinction is often made between fine sand which is confined and that which is unconfined. The surrounding of a foundation site with tight sheeting is useful in preventing subsequent lateral displacement in the event of the making of adjacent excavations, but it does not, in the writer's opinion, increase the bearing value. If the material is pure sand, it will not flow under pressure alone except under excessive loading. In the case of those sands containing a considerable quantity of clay this may not be true. It is not easily possible to determine how much, if any, clay is contained in a fine sand. The individual grains of sand may be and usually are so small as to give the mass which they form, the general appearance of clay. A microscope may be

required in such case to determine accurately whether the particles are of sand or clay. Generally speaking, fine sands containing a considerable quantity of clay will not show the characteristic behavior of quicksand.

Before deciding to utilize fine sand as a foundation for permanent structures, consideration should be given to the future possibility of its becoming saturated under a head which may produce quicksand.

The writer recalls a case in which some mill buildings were built upon fine sand on the high bank of a river. Later a power dam was constructed at a still higher elevation above the mill site, and in the course of time the water impounded behind the dam found its way under the dam and into the fine sand which formed the foundation of the mill buildings. This condition was unknown until the pressure broke through to the river, undermining one of the buildings and causing its complete collapse. It should be noted, however, that in this, as in all similar failures, the sand under the foundation flowed to a lower level.

Those who have had occasion to drive piles into fine sand have usually found a very decided resistance against penetration in such material. This is but another indication of the natural compactness of fine sand in a quiescent state. If a water jet be resorted to, however, and applied to the soil in advance of the pile tip, it will be found that the pile will sink under the weight of the hammer alone. In other words, a quicksand condition is produced in the sand at the pile point, and the material no longer offers resistance to the load upon it. It is to be recommended, therefore, that in driving either bearing or sheet piles into fine sand, the water jet should be used as an economic aid to facilitate the work.

In connection with the installation of a number of precast concrete piles some years ago, the writer utilized the jetting process in sinking through a deep bed of fine sand as follows: A long length of 1/2-inch gas pipe was connected by ordinary garden hose to the city pressure, and a jet sounding was made at each pier location at an expense of 1/2-cent per linear foot. Piles were cast of the predetermined length and were jetted down by churning them up and down with an ordinary derrick, a jet pipe having been cast in the center of each pile and connected at the top during driving to a pressure

pump. Upon the removal of the jet action the sand repacked itself around the pile in a condition of maximum density.

A frequent cause of trouble from quicksand has to do with its escape into sewers, drains or other artificial underground conduits, thus producing voids which must be filled by settlement from above. Any open pipe or conduit laid through wet sand should be constructed with especial care to exclude the surrounding sand. Because of the extreme fineness of many sands this is not easy of accomplishment. When drains are to be laid in such material for the purpose of lowering the ground water level, and open joints are left in the pipes to accomplish this result, not only should the joints be wrapped with cloth to exclude the sand, but the entire pipe should be surrounded with soft coal cinders, which are among the most useful agents for admitting water while still excluding the passage of sand.

Cinders are also useful during the process of excavating into quicksand, for the purpose of maintaining a footing upon which the workmen may stand without sinking into the sand. A frequent liberal sprinkling of this material over the bottom of the trench will be found very effective in preventing miring.

It will also be found in the handling of many quicksands that the ordinary garden fork is more efficient for the purpose than is the type of shovel usually employed. This is due to the fact that fine wet sand has a very pronounced suction, which causes the blade of the shovel to stick and requires a greatly increased force to remove it.

In conclusion, then, summarizing the foregoing, it may be said that quicksand is only a temporary condition of a soil, which ceases to exist after a normal state of ground water has been restored. It is also probably true that many of the troubles encountered from quicksand could often be avoided by the adoption of more scientific methods of handling.

Further, it is the writer's conviction that the behavior of fine sands under conditions of quickness is in strict accordance with well-recognized physical laws and not the result of mysterious or unexplainable influences as is so often readily assumed by many of its victims.

ACKNOWLEDGMENT:—A paper read at the annual convention of the New England Water Works Association, September, 1920.

A New Excavator Crane

AS a further development of its excavating machinery, the Pawling & Harnischfeger Company, Milwaukee, Wis., has brought out its No. 206 machine, which is a heavy-duty, large-capacity excavator of the full tractor type. The corduroy traction consists of 20-inch-wide cast steel treads. The sprockets, which are placed on 9-foot centers, are of manganese steel, bronze-brushed, and adjustable to take up wear. The short turning radius gives it extreme ease of handling, a complete turn in twice its width being possible. Because no leading-wheels are used, this crane has a large radius of operation, getting into locations and over uncertain soil as readily as the now famous tanks did in Europe.

Two traction speeds are provided, one for moving from one location to another over roads or good earth surface, and a lower speed to be used when soft or extremely hilly surfaces are encountered, and when coming out of deep ditches. The power plant consists of a 4-cylinder Waukesha heavy-duty motor, 50-h.p. Warner vacuum feed, so that fuel is supplied the engine regardless of the position of the crane; and a storage tank carried below at the rear sufficient to provide for about 20 hours' continuous operation. For use with a 34-yard bucket, a 30-foot boom of braced structural



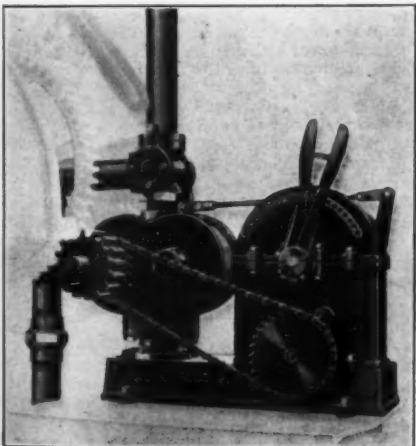
A HEAVY-DUTY FULL TRACTOR TYPE EXCAVATOR

steel is furnished, or a 38-foot boom for a 1/2-yard bucket—drag-line or clam-shell. Back filler, lifting magnet, or slings may replace the bucket for filling or material-handling duties.

All operating levers are located convenient for one operator on the right side, as shown in the accompanying illustration, giving him complete control of all movements and operations.

An Automatic Meter Pump

CONSIDERABLE interest is being manifested in a detailed report just published on a series of tests recently undergone by a new automatic meter-pump designed by



THE AUSTIN METER PUMP FOR CONCRETE MIXERS

an engineer connected with the Austin Machinery Corporation of Chicago.

This novel device, as its name implies, measures the water discharged into concrete mixers and paving machines. It insures a uniformly accurate quantity for each batch.

Simplicity is its main characteristic—it is simple in both construction and operation. Setting a pin for the exact quantity of water required takes but a moment, and then no more attention is required until the job is done, except, possibly, to move the pin a hole or two to offset any variations likely to occur in the moisture of the ingredients.

The device consists of a pump, a valve, a timer, and a few pipes and fittings. The pump is driven from the mixer-shaft. It works continuously. It can lift water approximately 12 feet from dead water to pump, or take water from hydrant. The two-way valve is "opened" and "closed" by means of a cam on the timer controlled by the starting lever. When the valve is "open," the water is discharged into the mixer; when "closed," it circulates through a return loop in the pipe.

The operator opens the valve by throwing the starting lever over to the timing pin. Then he forgets it until the next batch is ready for water. The valve closes itself automatically at the precise moment the predetermined quantity of water has been discharged.

How much or how little water is required

makes no difference to this device, as it has a range of about 250 per cent between minimum and maximum discharge.

Throwing the starting lever is the work of an instant. It does not interfere in any way with the operator's regular duties.

The total weight of the device does not exceed 200 pounds.

The report states that the tests to which this device was subjected were not confined to the usual factory routine, but extended over a

period of time in actual practice.

Inspector H. C. Daniels, in charge of the concrete work on a new nine-story Marshall-Wells warehouse, after describing in detail the methods pursued, says: "The concrete has turned out to be so dense as to be practically water-proof; consequently, the concrete should be of the greatest strength. * * * From the experience above mentioned I can say without any hesitation that your water-meter is a decided success in all respects."

Piston Air Drills

IT is a long call from the drill originated by the savage—who bound a splinter of flint into a cleft stick and rolled it between his palms, with a great deal of labor and infinite patience making a hole in a bright pebble or a piece of mother of pearl to make himself a bead—to the improved ball-bearing pneumatic drills now used by contractors in metal and wood work.

One of the interesting types of pneumatic tools manufactured by the Chicago Pneumatic Tool Company, 6 East 44th Street, New York City, is the "Little Giant" portable air drill made in a wide variety of sizes and types for drilling, reaming, tapping, flue-rolling, counter-sinking, screw-setting, wood-boring, nut-and-bolt tightening, etc. These machines are made after a standard pattern, varying only in size and construction necessary to adapt them to the particular uses for which they are intended. The principle of the drill has been proved to be very satisfactory, as it is particularly durable, and also economical in air consumption. It has been improved and simplified in construction since its first inception and is now creditably meeting conditions in railway shops, field work of contractors, and in many manufacturing establishments.

The machines are of the balanced-piston type and consist of four single-acting cylinders arranged in pairs, each pair of pistons being connected to opposite wrists of a double crank-shaft; the pistons of each pair travel in opposite directions at all parts of the stroke, thereby insuring a smooth-running machine. The balanced piston valves were formerly set to cut off at five-eighths of the full stroke, but in the latest improved types the valves have increased area and shorter ports, resulting in quicker admission and exhaust, and are so located as to cut off a little later, avoiding freezing of the exhaust.

The piston is made with the rod pressed into place. This arrangement has been tested for a number of years and found to practically eliminate troubles experienced in the past owing to the piston's becoming detached from the crank, and as a further safeguard against this, the piston rods are furnished with a clamp nut serving a two-fold purpose, namely, acting as a

lock-nut on the toggle, and, as it clamps the piston rod at a point about the middle of its length, materially stiffening the rod and contributing greatly to its strength. The construction of these machines, however, is lighter, which greatly reduces the wear on the reciprocating parts.

One of the special features insuring constant and efficient operation is the enclosed chamber in which the crank shaft revolves, which is designed to be kept partly filled with lubricant. After an exhaustive series of tests a special grease has been prepared for use in these chambers. The grease is injected into the drills by means of a squirt gun or syringe and, through the arrangement of the bearings and packing rings, is confined within the casing. All the four cylinders open at their rear ends into this compartment, and the gear case also communicates with and forms a part of this chamber or oil receptacle. When the machine is in use, the rapid motion of the crank throws the enclosed oil over the parts located in the chamber and in the gear case, thereby insuring perfect and continuous lubrication of all the parts. In these machines the exhaust air does not pass through the working parts, therefore there is no drying of the oil as is the case with machines which exhaust internally. This method of exhaust prevents any particles of dirt or dust contained in the air from getting into the working parts of the machine.

While the "Little Giant" drills are so constructed that if oil is put in at one place it will reach all the moving parts, including the valves and their attendant mechanism, yet the lubricant should be put in at frequent intervals because the high speed at which the motor operates, together with the ever-present air pressure in the crank case, will use up the oil much faster than in the older types of drills which operated at much lower speed. Due consideration should be given the question of lubrication, as it means long life and minimum maintenance. Any good heavy lubricating oil can be used in the crank case, although the oils compounded by this company are particularly recommended in the interests of economy for this particular type of drill.

BOOKLETS FOR BUSY CONTRACTORS

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

A FREE DATA BOOK ON ROADS

Concrete highway contractors will be interested in the National Handbook, published by the National Steel Fabric Co., 909 First National Bank Bldg., Pittsburgh, Pa., which contains a fine collection of data on road building.

Making Profitable Use of Motor Trucks

In a pamphlet full of pictures and diagrams the Selden Truck Corporation, Rochester, N. Y., explains how contractors particularly may make extremely profitable use of their motor trucks.

TRENCH EXCAVATORS

If you are looking for a trench excavator which is accepted by contractors as having made good, write to the Buckeye Traction Ditcher Company, Findlay, Ohio, and ask for a copy of the catalog containing particulars with regard to Model C trench excavators.

REINFORCED CONCRETE CHIMNEYS

The Weber Chimney Co., 332 South Michigan Ave., Chicago, Ill., designers and builders of reinforced concrete chimneys, have published catalog No. 19, illustrating and describing a large number of exceedingly interesting chimneys it has built throughout the world.

WELDING AND CUTTING METAL EXPEDITIOUSLY

The Oxweld process of welding and cutting metal by use of the oxy-acetylene flame is very important to contractors engaging in any form of metal structural work. Catalogs A- and A-4, published by the Oxweld Acetylene Company, 30 East 42d St., New York City, contain valuable data and information for contractors.

MOTOR TRUCKS DESIGNED FOR CONTRACTORS

A well-illustrated, descriptive booklet on "Republic Trucks for General Contractors" may be secured by any interested parties from the Republic Motor Truck Co., Inc., Alma, Mich.

MONTHLY DATA ON CRANES

The interesting house organ of Industrial Works, entitled "Crane Comments," containing material on various types of cranes in operation, may be secured by contractors and engineers interested, by sending their names to Henry Martin, Advertising Department, Industrial Works, Bay City, Mich.

BLAST HOLE AND WELL-DRILLING TOOLS

Facts concerning the valuable attributes of "Clipper" blast hole and well-drilling machinery for quarrymen are given in the interesting and complete catalog of the Loomis Machine Co., Tiffin, Ohio.

HEATERS FOR CONCRETE MIXERS

Bulletin No. 130, issued by the Hauck Manufacturing Co., 126-134 Tenth St., Brooklyn, N. Y., contains information regarding the overcoming of winter concreting problems through the use of Hauck heaters for concrete mixers.

MOTOR TRUCK SERVICE

The Service Motor Truck Company, Wabash, Ind., has published a 43-page booklet stating the fundamentals to be considered in choosing a motor truck, and outlining the features of Service trucks with special and standard bodies which will be of interest and value to contractors.

TRENCH BRACES FOR SPRING WORK

In a 20-page catalog, the Duff Manufacturing Co., 530 Preble Ave., Pittsburgh, Pa., gives full details regarding Duff-Dunn patent trench braces, which will be of interest to contractors.

COMPLETE CATALOG OF ENGINEERING INSTRUMENTS

A complete catalog of Gurley engineering instruments commemorating the 71st anniversary of this firm of well-known instrument makers, may be secured by writing to W. & L. E. Gurley, Troy, N. Y.

MOTOR-DRIVEN AIR COMPRESSORS

Many contractors are called upon to operate pneumatic apparatus involving the use of air compressors in localities where electric current is available. For these jobs, motor-driven air compressors will be found economical and highly desirable. Publication No. 9035, issued by the Westinghouse Traction Brake Co., Industrial Department, Pittsburgh, Pa., contains much information on this subject.

TRENCHING MACHINES

For full information regarding a really dependable trenching machine that will speed up pipe-laying, write for a copy of A-118 issued by the Austin Machinery Corp., Railway Exchange Bldg., Chicago, Ill.

A-1 EQUIPMENT FOR SALE OR RENT

The Contractors' Machinery and Supply Co., 509-11-13 Wabash Bldg., Pittsburgh, Pa., offers for rent, lease or sale a large selection of used equipment for contracting.

ROAD-BUILDING MACHINERY

Contractors' supplies for road building are described in the very complete catalog No. 9, which may be secured on request from the Acme Road Machinery Co., Frankfort, N. Y.

MOTOR TRUCKS FOR ROAD BUILDING

In a instructive booklet entitled "White Good Roads Trucks," the White Company, Cleveland, Ohio, describes the use of its trucks for hauling, dumping, spreading and rolling road material and pulling road machinery, and the White combination distributor for applying bituminous materials.

CONTINUOUS ASPHALT KETTLE

Bulletins 5, 6 and 8 of the Iroquois Sales Dept., The Barber Asphalt Paving Co., Philadelphia, Pa., contain complete descriptions of Iroquois continuous asphalt kettles (which prevent delays in asphalt road work) and the other tools which make the Iroquois line valuable to contractors engaged in such work.

SPEED UP RIVET CUTTING

Booklet No. 5, published by the Rivet Cutting Gun Co., 113 East Third St., Cincinnati, Ohio, contains valuable information on the use of the Cincinnati Rivet Cutting Gun for the removal of loose rivets from all kinds of structural steel work.

DETAILS OF BITUMINOUS PAVEMENT CONSTRUCTION

A 38-page booklet showing and describing step by step in actual photographs the construction of a Tarvia pavement, has just been issued by the Barrett Co., 17 Battery Pl., New York City, and may be secured on request by those interested in road construction.

A SMALL ROAD-BUILDING TRUCK

Full information regarding the GMC road builder, a handy truck of one-yard capacity, may be secured by writing to J. E. Baird, General Motors Truck Company, Pontiac, Mich.

HOW TO BUILD ASPHALT PAVEMENTS

All types of asphaltic construction for roads with brief descriptions of the various steps, illustrated with photographs and diagrams, may be secured free from the Asphalt Sales Department, The Texas Co., 17 Battery Pl., New York City.

GASOLINE INDUSTRIAL LOCOMOTIVES

In a complete illustrated booklet, the Hadfield-Penfield Steel Co., Bucyrus, Ohio, describes its American gasoline locomotives, designed and built to meet every requirement of industrial railway activity, particularly in road construction.

PROPER SHOVEL HANDLES

A shovel handle with a heavy forged socket and double angle D is described in a leaflet which you may secure by writing to the Steel Basket Co., 708 South Third St., Cedar Rapids, Iowa.

HOISTING ENGINES

In catalog No. 15, issued by the J. S. Mundy Hoisting Engine Co., 727 Frelinghuysen Ave., Newark, N. J., are published descriptions and data regarding all types of hoisting and handling machinery for contracting.

HOISTS AND DERRICKS

An elaborate book of 175 pages filled with photographs, figures and diagrams relative to hoists and derricks is being distributed by the Clyde Iron Works, Duluth, Minn.

AN ALL-ROUND EXCAVATOR CRANE

Bulletin 5X, which has just been published by Pawling & Harnischfeger Co., Milwaukee, Wis., describes its excavator crane No. 205, with illustrations depicting the excavator at work with a digging bucket, back-filling scraper bucket, clam-shell bucket, lifting magnet, special grapples for lumber and sling chain.

TRAILERS FOR HEAVY LOADS

Contractors finding it necessary to haul unusual loads may secure information regarding the effectiveness of trailers by writing to the Arcadia Trailer Corp., Newark, New York State.

CONTRACTORS' EQUIPMENT

Catalog 69, which can be secured from the Standard Scale and Supply Co., 1631 Liberty Ave., Pittsburgh, Pa., contains complete descriptions of the "Standard" line of contractors' equipment, including concrete mixers, street pavers, hoists, pumps, gas, gasoline and oil engines, material elevators, wheelbarrows, etc.

CUTTING CONTRACTORS' HAULING COSTS

The Barrett-Cravens Co., 160 Ann St., Chicago, Ill., has issued a booklet, "Hauling at a Saving," describing its Powerox tractor truck, with details and specifications.

SAFE STORAGE FOR GASOLINE

Full information regarding the convenience, economy, efficiency, service and safety of Bowser oil and gasoline-handling equipment may be secured from S. F. Bowser & Co., Inc., Fort Wayne, Ind.

VALVE-FITTINGS—STEAM SPECIALTIES

The special catalog of the Crane Co., 536 South Michigan Ave., Chicago, Ill., contains complete information regarding Crane valves, fittings and steam specialties for all sizes and pressures, for steam and for air.

TANDEM PAVING ROLLERS

The illustrated literature of the Erie Machine Shops, Erie, Pa., contains detailed information regarding the uses and effectiveness of Erie tandem paving rollers.

ELEVATED STEEL STORAGE TANKS

The Pittsburgh-Des Moines Steel Co., 1007 Curry Bldg., Pittsburgh, Pa., has issued an attractive bulletin describing its elevated steel tanks for storage purposes, which will be of interest to contractors.

ROAD-BUILDING AND QUARRY EQUIPMENT

Complete catalogs covering crushers, elevators, screens, bins, motor trucks, sweepers, scarifiers, oilers, car unloaders and motor flushers, may be secured from the Universal Road Machinery Co., Kingston, N. Y.

DEPENDABLE TRENCH PUMPS

Details and literature regarding Atlantic pumping engines for pumping water from trenches and excavations may be secured from Waldo Brothers and Bond Co., 181 West Congress St., Boston, Mass.

WOOD BLOCK PAVING

Complete information, data and literature regarding wood block pavement may be secured from the Republic Creosoting Co., Indianapolis, Ind.

STEEL FORMS HELP PAVING RECORDS

Complete information regarding Heltzel steel forms and what they have meant to paving contractors in speeding up construction work may be secured from the Heltzel Steel Form and Iron Company, Warren, Ohio.

POWER SHOVELS FOR EXCAVATION

The Thew Shovel Company, Lorain, Ohio, will be glad to furnish interested contractors and engineers with data regarding the performances of Thew power shovels on different types of excavating work under varying operating conditions.

USED EQUIPMENT FOR SALE OR RENT

Complete lists of used equipment for sale or rent with immediate delivery may be secured by writing to the Frank T. Craven Co., 48 Church St., New York City.

INDUSTRIAL LOCOMOTIVES

The catalog of the H. K. Porter Co., Pittsburgh, Pa., describing its industrial locomotives, which are claimed to give "less trouble—more work," may be secured by interested contractors on request.

CAST IRON PIPE FOR ALL PURPOSES

The descriptive literature of the United States Cast Iron Pipe and Foundry Co. gives complete information regarding the use of bell-and-spigot, flanged, plain-end and flexible-joint cast iron pipe for water-mains, steam-mains, gas-mains and submarine lines, as well as special castings for other work.

SALE OF USED EQUIPMENT

Philip T. King, 30 Church St., New York City, will be glad to furnish contractors and contracting engineers with a list of used equipment for use in construction work at any price.

THE TRUCTRATOR FOR CONTRACTORS

The Clark Tructractor, a small gasoline-power truck of neat construction, which is very readily maneuvered and applicable to all types of contracting work, particularly road work, is described in a bulletin which may be secured from the Clark Tructractor Co., 1139 Dago Ave., Chicago, Ill.

STEAM SHOVELS WITH A REPUTATION

Bulletin G-G, issued by the Bucyrus Co., South Milwaukee, Wis., gives complete information regarding the dependability, low cost of operation, and steady output of Bucyrus shovels, made in the railroad type, revolving, drag-line excavators, dredge, etc.

PROVIDE EXPANSION FOR PAVEMENTS

The ideal expansion joint, which is carried in standard sizes and packed ready for shipment, is described in literature which may be secured from the Waring-Underwood Co., Commercial Trust Bldg., Philadelphia, Pa.

UNBREAKABLE MANHOLE COVERS

A heavy-duty manhole cover which will interest contractors is now being manufactured by the Central Foundry Co., 90 West St., New York City, and is described in its literature.

DOUBLE-ACTING PILE HAMMERS

Bulletin No. 28, just issued by the McKiernan-Terry Drill Co., 19 Park Row, New York City, describes in detail the advantages and uses of double-acting pile hammers.

EXPANSION JOINTS FOR ROADS

An expansion joint that is easy to handle is manufactured by the Philip Carey Co., 9 Wayne Ave., Lockland, Cincinnati, Ohio, and described in its literature.

FREE OFFICE CALENDAR

A well-printed, easily-read calendar, displaying three months at a time has been issued by the Trucon Steel Co., 58 Lafayette Blvd., West, Detroit, Mich., and may be secured by engineers and contractors writing on their own business letterheads.

CONTRACTORS', ENGINEERS' AND MANUFACTURERS' NOTES

Austin Absorbs Fairmount Machine Company

Through a deal of more than ordinary importance, the large plant of the Fairmount Machine Company, Fairmont, W. Va., becomes the property of the Austin Machinery Corporation, of Chicago and New York, manufacturers of earth-working, concrete-mixing and material-handling machinery. This acquisition substantially increases the already extensive line of products and manufacturing facilities of the Austin Machinery Corporation.

The Fairmount plant will continue to make its own line of machinery, besides contributing to the manufacture and distribution of the line of earth-handling and cement-mixing machinery manufactured by the new owners.

New Sales Office in Atlanta, Ga.

The Chicago Bridge and Iron Works, Chicago, Ill., has announced the opening of a new sales office in the Forsythe Building, Atlanta, Ga. Joseph L. Zeller, who has been connected with the company for a number of years, will be in charge and will handle the states of Georgia, Alabama, Tennessee and Florida. This company confines its activities chiefly to the manufacture of elevated tanks, large storage tanks and similar plate work.

New Road Machinery Booklet in Spanish

F. H. Conklin and W. G. Harrington, Inc., 50 Church Street, New York City, acting as the Export Department for the Good Roads Machinery Company, 836 Bulletin Building, Philadelphia, Pa., has published a complete catalog of Champion and Climax rock-crushing and road-building machinery, Monarch road rollers and Winner road graders, in Spanish, for the Central and South American export trade.

Blanchard Retained by Colorado Springs

Announcement has just been made that Professor Arthur H. Blanchard, consulting highway and transport engineer, Ann Arbor, Mich., has been retained by the city of Colorado Springs in connection with its \$1,200,000 paving program.

Thew Has Enlarged Plant

The Thew Shovel Company, Lorain, Ohio, has enlarged its plant, added new equipment and a well-organized service department. This company specializes in steam, electric and gasoline power shovels and cranes from 1/4-yard capacity, 14 tons working weight, to 134-yard capacity and 70 tons weight.

Engineering Firm Reorganizes

The business of Miller, Holbrook, Warren & Co., Milliken Building, Decatur, Ill., has been purchased by the new firm of Holbrook, Warren & Andrew. Under the former name the firm has built up a substantial professional business in the structural and municipal field. The three members of the firm have been active in municipal and governmental work for some time. Frank D. Holbrook was engaged for a period of about 15 years on Ohio River improvements for the United States Government. Willis D. P. Warren has been engaged in various classes of engineering work in Illinois for 17 years and has put in the greater part of his time on municipal projects. Captain Clarence R. Andrew was formerly with the Government on Ohio River improvements and served in France in the Engineer Corps.

New Eastern Manager for Chicago Pneumatic Tool

J. F. Huvane has been appointed Eastern Manager of Compressor and Engines Sales of the Chicago Pneumatic Tool Company, with headquarters in New York City. G. C. Vandenberg has been appointed Western Manager, with headquarters in Chicago.

Adamson Increases Product

The Adamson Manufacturing Company, East Palestine, Ohio, has added a new department for the manufacture of all kinds of storage, pneumatic and pressure tanks, welded pipe, battery casings, evaporators, condensers and a large line of arc-welded products adaptable to the requirements of the contracting and building industries.

Thayer Succeeds Late William T. Becker

The Acme Road Machinery Company, Frankfort, N. Y., has announced that Joel A. Thayer, who for the past thirteen years has been Superintendent of Streets for Taunton, Mass., has resigned from that position, effective February 1, and has become New England Manager of the Acme Road Machinery Company, assuming direction of the Boston office at 141 Milk Street. Mr. Thayer succeeds the late William T. Becker, who filled this position for many years and whose death occurred on December 3, 1920.

Atlanta Office Opened

A district office in charge of H. S. Gibboney, District Manager, 604 Walton Building, Atlanta, Ga., has been opened by the National Steel Fabric Company, whose home office is First National Bank Building, Pittsburgh, Pa.

The Contracting Industry Depends on Machinery



W. H. TEMPLETON, ROAD CONTRACTOR, MAKES GOOD USE OF HIS REPUBLIC TRUCK ON ROAD WORK WHETHER IT BE HAULING MATERIALS OR, AS SHOWN ABOVE, BREAKING UP THE SURFACE



FOR ACTUAL TEAM WORK IN EXCAVATION AND DIRT MOVING IT WARMS THE COCKLES OF A CONTRACTOR'S HEART TO SEE THE OPERATOR OF A STEAM SHOVEL AND THE DRIVER OF A TRUCK PULL TOGETHER



TYPE OF 5-TON WHITE TRUCK PURCHASED BY THE CITY OF NEW YORK FOR THE DEPARTMENT OF STREET CLEANING, AND ADAPTABLE TO CONTRACTING

Contractors interested in obtaining correct cost data on their motor trucks may secure copies of the National Standard Truck Cost System gratis by writing to the Editor, Contractors' and Engineers' Monthly, Tribune Building, New York City.



A KINNEY ROAD OILER IN ACTION

The Tracking of Trailers

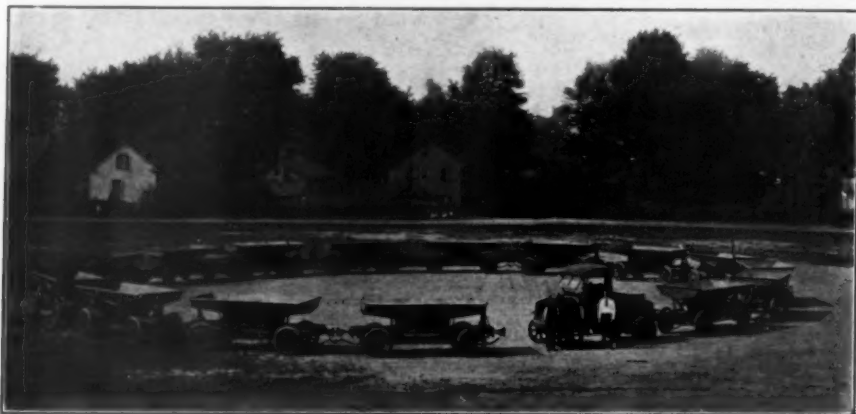
EACH year a greater number of people are using motor truck trailers in connection with motor trucks in order to make the trucks more profitable by doubling the number of tons drawn over the road in a given period of time.

It will, therefore, be interesting to many of our readers to note the accompanying illustration, which shows sixteen Arcadia trailers in a circle, all drawn into position by one 5-ton tractor. It will be noticed that the tractor is weighted down with a concrete block in order to give it sufficient traction. This tractor and trailer equipment is being used by the city of Syracuse for the removal of ashes, rubbish, garbage, etc. It is manufactured by the Arcadia Trailer Corporation, Newark, N. Y.

The construction of the steering mechanism of these trailers is such that the trailer will keep practically in the track of the towing vehicle ahead. This construction enabled the

towing-hook attached to the motor truck or towing vehicle. It is the turning of the draw-bar that swings the front wheels to the proper angle to insure the tracking of the trailer behind the towing vehicle. To determine the accurate angle at which the trailer will turn involves delicate measuring and figuring.

To get this precise tracking, there must be taken into consideration the distance from the rear axle of the towing vehicle to the center point of the towing-hook, which is usually attached to the rear frame member of the truck; then the length of the connecting bar, the distance from the pin in the draw-bar mouth to the king-pin or pivot-pin, together with the correct distance from the pivot-pin to the draw-bar steering-ball, then by the properly constructed drag-link to the steering-arm on the axle knuckle, at which point the length and shape of the steering-arm must be carefully calculated in order that the trailer may track



A CIRCLE OF ARCADIA TRAILERS FORMED BY TRACKING

tractor in the above picture not only to draw the trailer into the circle, but also to continue around the circle.

In construction the Arcadia uses trailer axles of the knuckle type, practically the same type of knuckle axle used on motor trucks. The bearings are of the roller type. A tie-rod connects the steering-arm of each knuckle. On one knuckle this arm is long enough to permit the use of a drag-link, which leads from the steering-ball on the end of the arm to a steering-ball on the end of the trailer draw-bar. The draw-bar is pivoted between two frame cross members and reaches a certain distance back of the king-pin or pivot-pin, and also reaches ahead and through the frame, terminating in a draw-bar head which is fitted with a draw-bar connecting pin.

To this pin is fastened the connecting bar, which operates between the trailer and the

properly. These are engineering details, many of them coming to light by the process of development, although they are not needed for general operation.

The Arcadia trailer is reversible, or, in other words, is alike on both ends and can be steered from either end. Therefore, in actual operation the front wheels are allowed to swing by the draw-bar movement, while the rear wheels are locked by a special locking device which keeps the draw-bar continually in the center, and thus keeps the wheels straight or parallel with the frame side members.

The same principle must be used in all trailers if they are to track properly. There is a difference between a "trailer" and a "wagon." The modern, successful trailer is the result of engineering development, based on motor truck construction, and is not the outgrowth of any attempt at horse-drawn wagon development.

The Evil of Overloading Motor Trucks

By R. H. Salmons

Vice-President, Selden Truck Corporation

THE recent authorization by the California Highway Commission of the purchase of six loadometers for the purpose of making a systematic weighing of motor trucks on the state highways, reveals a determined effort to keep overloaded trucks from the roads. Up to a short time ago no attempt had been made anywhere in the country to compel motor trucks to observe the maximum load violations. With the increase of motor transportation and the consequent greater wear and tear on the roads, the attention of officials in a few places which have laws regulating truck loads was directed to the matter primarily as a means of road preservation. While it is admitted that the majority of the roads are by no means what they ought to be, they must be taken as they are until means are found to improve them properly, and it is an evidence of wisdom as well as justice on the part of highway officials toward all



DUMPING A LOAD OF STONE BY THE ROADSIDE FOR FUTURE REPAIRS

road users to keep the load weights within reasonable bounds.

In New Jersey, which has tackled this problem of excessive motor truck loads more thoroughly than any other eastern state, the plan was adopted, early in the summer, of weighing trucks which appeared suspiciously heavy. This was merely preliminary to a more determined effort. It is

now announced that proper scales have been purchased and placed at five selected sites along the thoroughfares.

The control of this whole matter is of direct interest, therefore, to all the taxpayers who are responsible for the up-keep of the highways of the country. It affects all towns and interurban stretches through which main trucking routes pass.

It took the railroads years to discover that gross overloading never pays in the long run. They found out that it was too expensive and dangerous a way to make money. A freight car, like



THE SNOW SCRAPER ENABLES THIS OWNER TO OPERATE IN WINTER

a truck, is built with a factor of safety to stand certain strains caused by uneven road-bed and pounding over cross-overs; if given proper care it will stand such strains without excessive overloading. Just think for a moment what may happen if a car axle breaks from such abuse—the whole train may be wrecked. Just as spectacles of this kind cannot be permitted to occur often on the railroads, so must the truck owners of the country war against similar accidents on highways.

Do Not Abuse the Factor of Safety

A truck will stand some overload; the manufacturer refers to this as the factor of safety. It is the designer's idea that this additional strength takes care of the greatest strains the truck may encounter when operated under normal conditions of load and speed. It might better be called a factor of ignorance, for the additional strength of the truck is expected by the owner to support the additional load put on it through ignorance. Although a machine may be carefully designed and conservatively rated at a certain capacity, with factor of safety, it does not mean that it will carry a 50 per cent overload without damage to the machine. Because the manufacturer claims the truck will carry 50 or 100 per cent overload is no reason why the load should be put on the machine. This should be counted as reserve capacity and would correspond to the capacity of a horse to pull 50 per cent or more overload on a grade. The man who drives horses would be foolish to keep them all of the time under a strain such as they would have on the worst part of the road. The same principle holds true for a truck.

A typical example due to overloading resulted in the loss of one-half gallon of oil per day from the oil pump that drives the hoist. It was proved that the trouble was due to gross overloading, because, when a new hoist was installed and only capacity loads were carried, there was no further trouble.

A more serious case caused by overloading was that of a contractor owning two 5-ton dump trucks of a well-known make. He had a contract hauling crushed stone out in the Cumberland Mountains. He thought he

could make more money hauling 8 tons per trip; this he did very nicely until just before he finished the contract. While one of the trucks was descending a mountain with an 8-ton load, something broke and the truck ran into a large boulder and was almost completely wrecked, and the driver was severely injured. The truck then caught fire and burned. The contractor was forced to go out of business because of the accident, and he acknowledged that overloading caused it all—not poor material or workmanship. The truck was not built to withstand such abuse.

The Proposed Uniform Vehicle Law

When the states generally take this matter up as New Jersey has done and a code of uniform laws is drafted and enforced, the evil of overloading will be less apparent. The proposed Uniform Vehicle Law, when completed, will be a forward step and should stabilize conditions materially. The best interests of the country will be served by the adoption of this law. As many of its provisions as possible should be enacted by each state. Especially is it important that the provisions as to speed, height, width, the rules of the road, etc., with the penalties for their violation, be adopted, so that when a driver or operator of a vehicle becomes familiar with the traffic laws of his own state he will be familiar with those of all the other states.

Truck abuse, whether it be overloading or anything else, is a grievous offense against business, because it blocks the progress of transportation, which is the life-blood of business. Millions of tons of freight are accumulating in this country every day on account of congested terminals. The task of moving it is too great for railroads; the less-than-car-load shipments are the permanent cargo of the trucks. A system of motor transportation is therefore needed to supplement the railroads. No railroad switchmen's strike or longshoremen's strike is required to enable the business man of vision to evaluate the worth of the continuous operation of an adequate transportation system.

ACKNOWLEDGMENT:—Illustrations by courtesy of Packard Motor Car Company.

High Speed Concrete Road Construction

By J. H. Lussen

RADICAL changes in methods of handling material relative to road construction work have been made during the last year. A very good example of a new method is illustrated by the accompanying photograph. This arrangement has proved highly successful, and it requires only a small investment for additional equipment to a road contractor's plant.

There was an interval following the war when contractors hesitated to submit complete contract prices on new proposals, principally on account of the uncertainties of the labor situation. However, all con-

good profits from road work.

Three Cooperating Mechanical Units

The new scheme for surmounting labor costs, for increasing the output, and for obtaining the highest efficiency from a contractor's present mechanical equipment, rests upon a combination comprising three distinct types of machines. Each one of these three mechanical units, therefore, has increased its value because of its indispensableness to the complete success of this new money-making combination. As may be noted in the illustration, one of the



WAGON LOADERS HELPING TO INCREASE THE OUTPUT OF THE PAVERS

tractors soon recognized that unless some fundamental innovation rose up on the old order of things, it would prove utterly profitless to attempt bidding for new work.

It seems but a short time since certain improved labor-saving machines were placed on the market, nevertheless, quickly as some engineers may have perceived their possibilities, the final successful combination of these particular machines, as applied to actual road construction, was a step-by-step process. Not until the ingenuity of a few practical engineering contractors demonstrated how nicely the results of these new machines dovetailed with one another, did there appear again a hopeful prospect of

machines is a self-propelled, self-feeding and self-crowding "path-digging" wagon loader; another is a Trutractor, and the third is a self-propelled concrete mixer for road paving. Leaving out any one of these machines would quickly raise the cost per cubic yard of concrete spread on the roadway. Attempting such illogical economy would be like trying to win a race in an automobile minus its pneumatic tires.

The photograph is of a section on the new Bronx Parkway, now under construction from the northern end of Bronx Park in New York City to the Kensico Reservoir at Valhalla, in Westchester County, N. Y., a total length of 16 miles. This beautiful

driveway skirts the banks of the little Bronx River, through a picturesque valley.

The road contractor is the Hastings Pavement Company. About one mile from the construction work the contractor obtains the necessary sand. This material is automatically loaded into a number of auto trucks at the rate of 5 cubic yards in 5 minutes, by means of a Haiss "path-digging" wagon loader. Two similar-type loaders may be seen operating on the new road; one digs sand and fills a measuring box, and on the opposite side the other digs crushed stone and also fills a measuring hopper. Beyond the loaders are two Foote concrete mixers, and running between these two sets of labor-saving machinery are the three Clark Tructractors.

The sand and stone piles dumped along either side of the road are of such amounts that when they are dug away a clear space, averaging 50 feet, is always maintained between the sand loader and the line of mixers, while on the other side a space of 75 feet is left open. By this arrangement, the Tructractors, after receiving their measure of sand, avoid getting into each other's way when they steer over to the stone loader. Loaded with material, the Tructractors then shoot up to the first con-

crete mixer having its power loader down for a fresh charge. At the same moment that the Tructractor dump-body discharges, a laborer empties a bag of cement in with the dry aggregate. Almost the next instant this material is sliding from the uplifted charging scoop into the revolving mixing barrel, and, finally, the wet mix drops from the end of a long swivel spout to the road.

The observed speed of each Tructractor was 1 minute for a round trip, with 1/2 cubic yard of material. Therefore the three Tructractors deliver 1-1/2 cubic yards in 1 minute to the two concrete mixers, or 3/4 cubic yard in 1 minute to each mixer. As to the number of laborers actually required, —three for the two loaders, three for the three Tructractors, two cement men, and ten men for the two mixer gangs; thus making a total of eighteen laborers.

It should be remembered that all the machines in this outfit are self-propelled, that the buckets on the wagon loaders are filled automatically, and that a path is cleaned up ahead of the loader wheels, all by means of the patented, self-feeding, propeller blades. Laying a road foundation at this speed means an immense saving in wages and time, which reacts to the benefit of the contractor.

New 1850-Yard Iroquois Stationary Asphalt Mixing Plant

IN a 1850-yard, straight-line, stationary asphalt mixing plant produced by the Iroquois Works of The Barber Asphalt Paving Company, Philadelphia, Pa., during the last year are embodied a number of new features which make for extreme economy and efficiency of operation, and thus have appealed to contractors and city officials in charge of paving operations.

The new plant is notable chiefly because of the compact arrangement of all parts on the steel frame. It will produce a maximum quantity of mixture with a minimum force. Although designed primarily as a stationary plant, it can be moved from one operation to another with comparative ease.

Low first cost, due to the compact arrangement, is an important advantage of the new Iroquois mixer. Low cost of operation is another feature, since fewer men are required to operate the plant. From the mixer platform one man can reach all levers and thus control every stage of the loading, mixing and discharging operations.

The plant is easy to erect, and the cost of

erection is low. With the whole plant on a single frame, all shafts, gears and other units stay in line. There is no need for careful lining up after erection, as in the case of plants the several units of which are assembled separately.

Either a portable boiler and engine or an electric motor can be used to operate the plant. Fuel oil burners are regular equipment for the heating drum, but coal can be used if desired.

The plant is elevated to a height of 8 feet or more above the ground level, and supported on three columns or piers. Thus ample room for teams or motor trucks to load is assured.

A portable 60-h.p. boiler and a 40-h.p. engine furnish power for the plant. The engine, of the single-cylinder, horizontal type, is placed above the boiler, which is mounted on wheels.

When specified, the plant is equipped for electric motor drive, either by direct gears or by belt. A 50-h.p. motor is recommended. A 30-h.p. boiler, mounted on wheels, is furnished with electric drive.

The elevator buckets are capable of handling 12 cubic feet of material per minute. As spe-

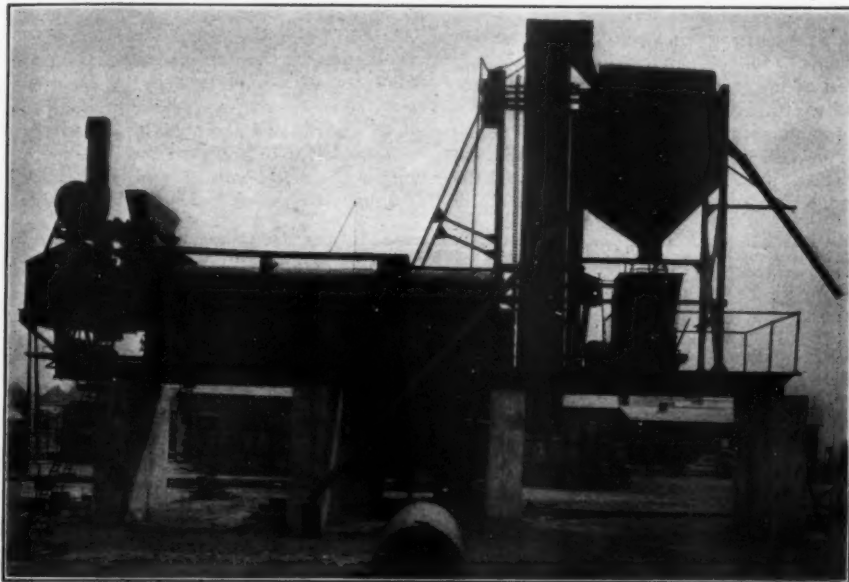
cial equipment, double cold-material feed is furnished. Material can be fed from either side.

The heating drum, of the revolving type, is 20 feet long and 48 inches in diameter. It is made of heavy steel plate with short channel flight inside for elevating and spilling the material. An air exhaust fan is provided for producing the necessary drum stack draft. The drum regularly is equipped with two 100-h.p. fuel oil burners. Coal-burning grates and

pipe, connected with the screen, and with an overflow pipe connected to each compartment. Separate discharge gates for each compartment, and operating levers, are furnished.

The weighing box, supported on an automatic, three-beam, enclosed platform scale, is made of steel plate with hinged gate at the bottom, which is operated by a lever. The asphalt bucket is of the revolving type, suspended on a two-beam scale.

The mixer is of the two-shaft pug mill type,



A BARBER-IROQUOIS STRAIGHT-LINE ASPHALT PLANT OWNED AND OPERATED BY THE DETROIT ASPHALT PAVING COMPANY

firing and ash doors will be provided under drum if specified.

The drum setting is made of steel plate, with double roof, sides, ends and bottom, and is lined with special fire brick anchored in place.

The hot-material chute is made of sheet steel, with wearing plates. The hot-material bucket chain is covered with a steel casing.

A two-section revolving screen, for fine and coarse material, is regularly furnished. The storage bin, of steel plates, is made with two compartments, and is equipped with a tailing

of 12 cubic feet capacity, and is steam-jacketed and equipped with steam dumping apparatus. A full set of universal blades, suitable for any mixture without change, is furnished as regular equipment. The blades are the combination type with cast iron shank with removable manganese steel tips. The plant is equipped with steam-jacketed pneumatic asphalt lift, air compressor, air receiver tank, and piping for elevating asphalt cement from kettles to weighing bucket, thus making it a complete independent unit.

Highway Research Work Assured

The Engineering Foundation, the Chairman of which is Charles F. Rand, 71 Broadway, New York City, past President of the American Institute of Mining and Metallurgical Engineers, has already raised a fund of \$500,000 to be applied to highway research. The Foundation is seeking to increase this fund to \$5,000,000, the income of which will readily carry out the work.

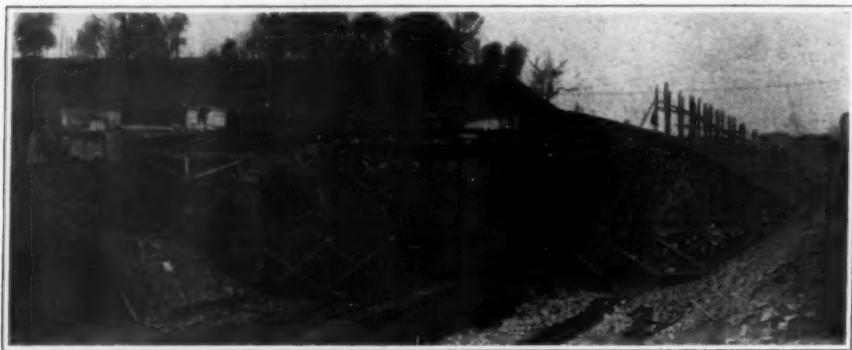
Functioning through the Engineering Division of the National Research Council, it is planned to cooperate all the agencies in highway research and, aided by the Federal Government, to employ highly trained research men who will gather scientifically the great mass of fundamental facts underlying the economic construction of modern types of highways.

Building a Three-Hinged Concrete Arch Bridge

Interesting Construction Work at Huffman, Ind., Miami Conservancy District

SOME interesting distinguishing features characterize the construction of the reinforced concrete bridge carrying the relocated Springfield Pike across the new tracks of the Big Four and Erie Railroads just east of Huffman Dam, Miami Conservancy District. The pike runs approximately parallel with the new tracks both east and west of the crossing, and in order to reduce the curvature at the two approaches to a minimum, a pronounced skew was necessary. This was fixed at 40 degrees from the normal. It was also necessary to build the bridge high and wide enough to afford clear-

floor to carry the highway traffic. This bridge was to be supported on heavy concrete piers and abutments. Such a design, while giving a very satisfactory and permanent bridge from several standpoints, was not built, as it was felt that the great weight and thickness of concrete provided would involve a greater expenditure than would be necessary with another type of construction. A reinforced concrete arch was proposed and finally accepted by all parties. The usual type of arch, whether in stone or concrete, is the so-called barrel type. It offers many advantages and was the first con-



FALSE WORK FOR THE HUFFMAN BRIDGE, SHOWING OPENING FOR OPERATION OF SINGLE RAILWAY TRACK DURING CONSTRUCTION

ance for four railway tracks, although only two are constructed at this time. This necessitated a span of 125 to 130 feet. The materials of the rather heavy rock cut to be spanned are limestone and shale intermixed with thin layers of clay.

Advantages of the Chosen Design

Under these conditions the type of bridge was determined only after much discussion. The bridge was built by the Conservancy District for the two railways, and, inasmuch as the latter were required to maintain the structure, with the exception of the roadway, after its completion, they were interested in the design. The Big Four Railway proposed a steel girder construction encased in concrete, with a reinforced concrete

considered. With the heavy skew necessary, the construction of the concrete forms would be a comparatively simple problem. Moreover, the abutments in the side of the railway cut to be spanned appeared to be of sufficiently solid rock to form a satisfactory support for this type of structure.

The Three-Hinged Arch

The alternative design considered was the three-hinged arch, the advantages of which are chiefly in connection with its freedom from temperature stresses. A barrel arch is practically a monolith with its end abutments maintained at a practically constant distance summer or winter. The exposed parts, however, expand and contract appreciably, lifting and depressing the crown and



THE COMPLETED THREE-HINGED CONCRETE ARCH BRIDGE AT HUFFMAN

introducing bending stresses in the barrel which tend to crack its upper and lower surfaces. Such cracks in barrel arches may be not infrequently observed.

In the three-hinged arch this difficulty is avoided by making the structure jointed instead of solid. The arch is completely cut in two transversely at each abutment and at the top of the rise, and a ring-and-pin joint is introduced at each of the cuts. The arch as thus made consists of two entirely separate pieces, each hinged at each end. When in hot weather such an arch expands, the crown is free to rise, each half swinging slightly upward on its abutment hinge, while the crown hinge, by turning slightly, prevents the formation of the bending stresses referred to above.

Besides having this advantage, the three-hinged arch is somewhat easier of design, owing to the more simple calculation of the stresses in the parts. On the other hand, the introduction of three hinges somewhat detracts from the rigidity of the structure laterally and makes it important to provide lateral stiffness in other ways.

The Huffman Bridge

The Huffman bridge is the second of this design to be built by the District. The first, which is at Taylorsville spanning the Baltimore and Ohio relocation, is not a skew bridge. The span of the Huffman arch between end hinges is 126 feet, and the rise to the crown is 21 feet, the ratio of rise to span being therefore 1 to 6. The arch ribs have steel reinforcement of round bars, but no structural steel shapes were employed except for connections. The hinges are of cast steel and the pins of bronze, $2\frac{1}{4}$ inches in diameter by 28 inches in length, the entire

thrust of the arch being carried by each pair of pins.

The roadway is carried by the arches at an elevation a few feet below the crown of the bridge, being hung from the ribs near the crown and supported on columns for the remainder of the span. The bridge is therefore of the type usually designated as a "semi-through arch." The roadway is 18 feet wide and is of the beam-and-slab type, three beams, one on each side and one along the center line, running the entire length of the structure, with cross-beams every 11 feet. This arrangement divides the floor space into squares of about 10 feet, occupied by concrete slabs 9 inches thick. The beams are 45 inches deep. A liberal provision for expansion was made in the floor by complete transverse joints introduced at intervals of 18 feet in the case of the central division, and of 33 feet in the others. The same joints were carried through the parapets, which are anchored firmly to the floor.

Details of the Work

One of the disadvantages of the three-hinged arch is that the concrete forms are more complicated than for a barrel arch, requiring greater labor in construction. At Huffman, also, an additional difficulty was introduced, because a single-track railroad had to be operated in the cut while the work was in progress, thus requiring an opening to be left in the timber false work sustaining the forms. This opening was spanned by heavy I-beams, as shown in the construction illustration. The $\frac{1}{2}$ -cubic-yard Smith concrete mixer was mounted at one end of the bridge, and the concrete was transported to the forms by a bucket hung from the traveler carriage running on a slack-line cable-

way erected over the false work. This cableway had a span of about 250 feet. One end was anchored beyond the end of the structure, the other was carried over a 45-foot mast and down to one drum of a two-drum steam hoist engine. The carriage was operated by a single line run back to the mast and down to the other drum of the engine. It can be pulled back to the mast by the engine, and in the other direction its own weight carried it. It could be poured at any point by slackening away on the main cable. This rig picked up the frame false-work bents and set them in place, also the longitudinal stringers and the steel I-beams spanning the opening for the railway track. It also handled the reinforcing steel and the steel hinge castings, as well as the concrete for the forms, the latter being carried in a 1-yard bottom-dump bucket.

The work suffered materially from delays in the delivery of materials, because of labor troubles of one kind or another at the mills,

and consequently the greater part of the concrete had to be placed in December, 1919, and January, 1920. This made it necessary to take precautions against freezing. An extra upright boiler was used to heat the water for the concrete. The sand and gravel were heated by being piled on old 15-inch dredge pipes in which fires were kept burning. The top of the structure was kept covered with canvas, under which salamanders were placed until the concrete had set beyond all danger of damage by freezing. On account of the rather open character of the structure, the protection during the cold weather was rather difficult, but it has apparently been sufficient.

The bridge was designed by Ross M. Riegel, Designing Engineer for the Conservancy District, and was built in the field under the direction of Leslie Wiley, Superintendent of Construction. The material for this article was secured from the *Miami Conservancy Bulletin*.

Portable Steam Pump For Dewatering Excavations

MANY contractors are already thoroughly conversant with the Pulsometer steam pump, which they are using in pumping operations and foundation and trench work successfully without the use of oil or any attention during the operation. Pulsometers have been known to work continuously for years; in fact, one owner has stated that his Pulsometer was entering its twenty-ninth year of service, doing the same type of work every day—the handling of gritty, sediment-laden water from a quarry—without a falter or a miss. The construction of these pumps is very simple, for there is a total absence of parts that slide and run one on another. It is claimed to be the only machine built, which does not need lubrication, since no friction is produced at any point during operation.

This pump does not require a specially built foundation. It can be fastened to a beam, hung on a hook and rigged up in any way and at any place, and will pump its full capacity. A little steam, piped from a near-by boiler, is all that is necessary to operate a Pulsometer, and, being a condensing pump, it gets two-fold use out of the steam, keeping fuel costs at an exceptionally low figure. In cases where the pump can be supplied with exhaust steam from other machines there is no cost for operation.

Not only water, but semi-solid fluids are handled by this pump. Anything that passes the intake is raised and passed without injury to the pump. The manufacturers, the Pulso-

meter Steam Pump Company, New York City, have specially designed and perfected a pump for handling gravel and large stones. Both the regular type and the special Pulsometer are used in sewer construction or foundation work, in quarries, claybanks, mines, railroad work, bridge-building, in irrigation work, and in many industries.



A HANDY, ALL-SERVICE STEAM PUMP

Preservation of Steel Bridges by Painting

Methods and Materials for Preventing the Rust and Pitting of Metal Structures

IN order to retain the initial strength of steel highway bridges it is essential that great care be taken to prevent the pitting of both tension and compression members, by thorough cleaning and painting. A number of interesting points regarding methods of cleaning metallic surfaces prior to repainting, the proper kinds of paint and the best methods of applying them, are brought out in a committee report recently presented to the American Railway Bridge and Building Association by J. R. Shean, of the Pacific Electric Railway.

Methods of Removing Rust

It has generally been found that when steel is new the rust appears only as light yellow spots here and there, which can be readily removed with scrapers made from old files turned over at the end and retempered and sharpened. Stiff scraper and putty knives are also useful for cleaning at this time. Steel brushes are not of much real value, except to remove dirt and loose mill scale. Any well-advanced corrosion which has pitted the steel should be chipped out with a hammer, great care being taken to get all the rust out of the pit so that clear steel shows at the bottom. However, care should be taken to avoid unnecessary cutting of the steel with the sharp edges of the hammer. The sand blast is an excellent and thorough method of cleaning steel which is badly pitted. It should be immediately followed, however, with the first coat of paint, as the surface begins to rust again very soon after a sand blast is used.

The tools necessary for cleaning steel structures before repainting are about the same as those used for new work. Light chipping hammers are indispensable for removing rough scale. For cleaning off dirt a small bunch of broom-corn wrapped with twine makes a handy tool. After the dirt has been loosened with broom-corn it can be brushed off easily with the duster, thus saving considerable scraping with the putty knife.

If a structure is properly treated when it is new, there is hardly any need of using a sand blast for repainting. The rust will

show only where it has been able to push the paint off. These spots should be chipped out until the pit formed by the rust shows the clear steel. Holding the blast on one of these spots until the pit is clear of rust will cause considerable unnecessary cutting of the steel around it. After the rust is cleaned, the bare places should be spotted with good red lead and then painted the same as the remainder of the bridge. If this work is done thoroughly there is no reason to expect further trouble from these places, but if it is not done well the rust will appear again in a short time.

The Proper Paint for the First Coat

After thoroughly cleaning the surface, a paint which will give the maximum protection against rust and prevent its getting another foothold should be used. There are several groups which will prevent the formation of rust, but most of them are impracticable for general use. The one most generally accepted by engineers for general use is red lead. This pigment has been severely criticized by many engineers and painters because of its tendency to sag and run on vertical surfaces, and to settle into hard, concrete-like masses at the bottom of the container. These faults are caused by an excessive amount of litharge, which sometimes amounts to 30 per cent of the cheaper grades.

In the last few years some lead manufacturers, by improvements and re-roasting, have reduced the litharge contents of red lead so that now the United States standard for this product is true red lead 94 per cent, and litharge 6 per cent. A few manufacturers have even improved on this standard, and it is now possible to buy red lead containing 2 per cent litharge and 98 per cent true red lead (Pb_3O_4). This produce makes an ideal paint for a first coat. Being extremely fine, it fills all pores, and brushes out into a smooth, even film, free from voids. It stays in place on vertical surfaces and does not act ropy under the brush. Another great advantage of using this high-grade material for the first coat is that it can be bought in paste form, saving the

time formerly consumed in mixing up the dry red lead by hand. The medium with which the red lead is mixed is fully as important as the pigment itself. The merits of linseed oil are too well known to need comparing with any other medium for this work, although the paint film is much better if reinforced with Japan oil.

Elaborate tests, recently made, have proved that, without reinforcing, an oil film loses from 18 per cent to 23 per cent of its volume in 200 days. This shrinkage of the oil film which should hold the pigment together is worthy of serious consideration, and Japan oil or anything else which will truly reinforce it should certainly be used. Japan oil also furnishes drier of the right kind, as rosin dryers are a detriment rather than a help to red lead.

The amount of red lead to be used in one gallon of medium is a question upon which engineers differ. On the Hell Gate bridge 37 pounds of red lead was used per gallon of oil, but this would be possible only with the very finest quality of red lead. The general average for railroad use is about 25 pounds to the gallon, or about 17 pounds to the gallon of paint mixed and ready for use. When steel work is to be painted at the fabricating works, care should be taken to have the specifications worded in such a way that no misconstruing of their intention will be possible. In any case, the inspector should make it a point to see that the intention of the specification is carried out.

The Final Protecting Paint Coat

What to use to succeed the red lead and to repaint the structure when necessary forms a question upon which there is considerable difference of opinion. Some authorities insist that a carbon base is the best, others insist that graphite is preferable,

while still others prefer mineral red or lamp black. Whatever the individual merits of these pigments are—and they probably are all good if applied right—the fact remains that they are all heat-absorbers. Inasmuch as heat is a destructive agent, it is hard to understand why dark colors are commonly used for final painting. Unless the price of material is the main consideration, there is no reason why steel work should not be painted in light colors, as their resistance to heat rays would certainly be more advantageous for the oil film which holds the pigment together, than the dark colors which attract and hold the heat rays.

Canary yellow, pearl gray or light olive green will change an unsightly black structure to one that will at least be more in harmony with its surroundings. These light colors will last enough longer than the dark colors to pay for whatever difference there is in the cost of the two. It may be argued that light colors become unsightly in a short time from dirt and smoke. This cannot be noticed to any extent except overhead on through truss bridges and on overhead bridges, but even if painted black the smoke marks show considerably on this part of a bridge.

The theory to follow when applying the coats which will follow the red lead, as well as at any other time the bridge is painted, is to have the last coat of paint more elastic than the coat preceding it. This will prevent checking and the formation of marking similar to alligator hide. Some authorities advise putting a little non-drying oil on the last coat to make a better water-shedding coat. This would appear to be a good plan, provided the paint finally dries hard by the time the bridge has to be repainted, so that the next coat is more elastic, thus avoiding the danger of checking.

Winter and Early Spring Storage

It is not too late to take advantage of early orders and the storage of material for the rapidly approaching spring road work. We have repeatedly advised in the editorial pages of the *CONTRACTORS' & ENGINEERS' MONTHLY* that contractors and highway engineers should cooperate in expediting

and increasing winter storage of road material along the site of proposed spring and summer road construction. It is a question of economy and production, and only through the cooperation of contractor and engineer can the full benefit of winter and early spring storage be realized.



Small Steam Shovels for Varied Work

A THEW shovel was shipped to Ellentown, Fla., in 1905, followed by another in 1906. At that time these two shovels were the latest development in small full circle swing power shovels, having a working weight of 14 tons with a dipper capacity of $\frac{1}{2}$ cubic yard. The above illustration shows the two shovels at work stripping overburden from a large area. A type 3 shovel shipped in 1914 is also shown. A record output of 12,000 cubic yards of fullers' earth, dug and dumped into cars during the short month of February, 1920, by shovel No. 1, shown in the middle foreground, was made. C. M. Schaefer, superintendent in charge of the work, stated:

"Our No. 1 and No. 2 type O shovels have been in constant use for fourteen and fifteen years respectively. During that time they have worked out about 45 acres of solid material

averaging 12 to 20 feet in thickness. The shovels are in good condition and are operating satisfactorily. I have been with these shovels thirteen years and have never known a gear to strip."

The application of the small steam shovel to various classes of work has received careful attention by the Thew engineers, who have tried to anticipate the demands of the contracting and industrial field.

Present-day requirements are clearly shown in the following illustration, showing a type O with a plate girder boom, a long dipper stick and a rugged, reliable, continuous-tread truck. This shovel was shipped to the same company in 1919 for use in stripping operations in southern Georgia. Balance, range and mobility have been given particular care in the design and construction of this new shovel.



A SMALL THEW SHOVEL WORKING IN A CRAMPED PLACE

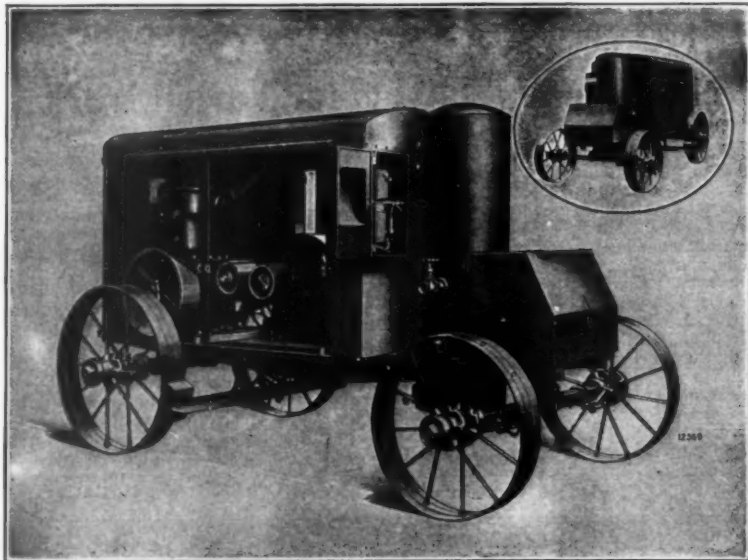
Portable Air Compressors

CONTRACTORS using compressed air are already familiar with the Ingersoll-Rand gasoline-engine-driven "Imperial" portable compressors. These units are driven by tractor-type gasoline motors and built in three sizes, with capacities of 45, 118 and 210 cubic feet per minute.

To meet the ever-increasing needs of the

motor-driven compressor, this electric unit is an all-steel outfit, from its sheet canopy to the broad-tired steel wheels. Light steel doors completely house the entire unit, protecting it from the weather. These doors are easily removed to allow free access to all parts.

Suitable intake unloader is provided, assuring efficient regulation. Either alternating or



A NEW TYPE OF READILY TRANSPORTABLE AIR COMPRESSOR

contractors, street railways and public service companies having available electric current, an electric-motor-driven "Imperial" has been added to this portable family. This unit is of 118 cubic feet capacity and weighs approximately 4,450 pounds, depending upon the weight of the motor. As is the corresponding gasoline-

direct current motor can be furnished. In any case, the motor control is in accordance with standard practice and specifications covering the type of motor used. Additional equipment includes air receiver, safety valve, drain valves, pressure gauge and service valves to which air hose lines may be connected.

Don't Be the Goat

Don't be the goat for the excavation contractor by allowing him to overload your truck and jam it to pieces with a steam shovel without recompense. When operating teams you would quickly call a halt under such conditions. It's just as disastrous to overload your truck.

Before going on to a job have an understanding as to maximum load to be hauled, the remuneration for it, and the contractor's

liability for damage done by the steam shovel. If you and every other truck owner going on to a job would get together on these points, you could curb this overloading abuse and form of robbery which actually takes money out of your pocket and puts your truck on the junk pile in a year, when you should get not less than five years' profitable service out of it, and more with any standard truck.

The "Why" of Safety First in Paver Designing

By R. E. S. Geare

General Sales Manager, The T. L. Smith Company

KILLED BY CONCRETE MIXER

"Leo Clay, colored, 5270 Bowen Ave., was killed and three men were severely injured yesterday when a concrete mixer being used to pave the street at Glenwood and Foster Avenues, overturned. L. W. Fausset, 4727 Columbia Ave., Harvey, Ill.; Harry Tyman, 2122 Kimball St., and Dominick Morell, 2128 Neenah Avenue, were injured."—*Chicago Tribune*, Oct. 15, 1920.

THIS is not the first instance of serious consequences resulting from the overturning of paving mixers that are not properly balanced. No one will deny that more attention should be given to designing mixers with Safety First in mind. And yet it is a fact that most of the machines on the market to-day are dangerous in many and various details of their designs.

Travelers' Insurance Company of Hartford, Conn., has published an article pointing out the mechanical hazards of concrete mixers, especially pavers, and bewails the lack of attention given to this danger by the designing engineers of manufacturers. To quote parts of this article:

"Guards for the exposed gears, belts, sprockets and chains, fly-wheels and other moving parts of the machines are the exception rather than the rule. Projecting set screws are quite common and they are always dangerous. All these moving parts are accident-producers which might be eliminated with comparatively little trouble or expense. As an illustration of the seriousness of the accidents that may result from lack of safety precautions in connection with concrete mixers, we may mention a case where a man's coat was caught by a set screw. The man was unable to release himself and was drawn against the unguarded gears of the mixer. His chest and right shoulder were crushed and he died almost immediately."

In addition to the dangers of overturning and of exposed gears, as mentioned above, there are other details in the design of most pavers which make them unnecessarily dangerous. Frequently the loading skip has been known to drop on the heads of workmen passing beneath it. Most pavers are not designed to avoid that danger. The low boom of most boom-and-bucket pav-

ers places another hazard in the path of the workmen. If the boom is not high enough to pass over the heads of these workmen, they are always in danger of being hit on the head or knocked down by the swinging boom.

Besides endangering the lives of the workmen, the paver that is not properly balanced is a dangerous thing for the contractor from an investment standpoint. When a paver turns over, the production loss is a serious consideration.

Among the several recognized paving mixer manufacturers, only one has apparently realized fully the value of designing safety first into its machinery. Although its pavers are designed to have their mixing drums high from the ground, which is a necessary safety detail, its heavier parts are underslung in such a manner that the center of gravity is lower than on any of the pavers of low-drum design.

In addition to designing his pavers to accomplish this low center of gravity, this manufacturer has carefully figured out a perfect balance on both a horizontal and a vertical plane so that danger of overturning is an impossibility under any conditions that may be encountered on road work. The designing of these high-drum pavers has been masterfully handled, and much credit is due to the ability and foresight of the engineers responsible for it.

Other Safety First precautions are designed into the pavers of this particular manufacturer. All the gears are completely guarded. A specially designed brake on the loading skip makes accidental dropping of the skip impossible. The skip cannot de-

scend until the operator releases the brake lever. This simple little feature of designing accomplishes a big purpose.

Then, as an extra precaution, guard-rails are provided by this manufacturer, at the sides of the skip, so that when the skip is raised from the ground, men cannot pass directly under it. The fact that these guard-rails are there would not prevent any man from deliberately placing himself under the skip, but they form an impediment and they serve the purpose in a practical manner by keeping the men away from the area directly under the raised skip.

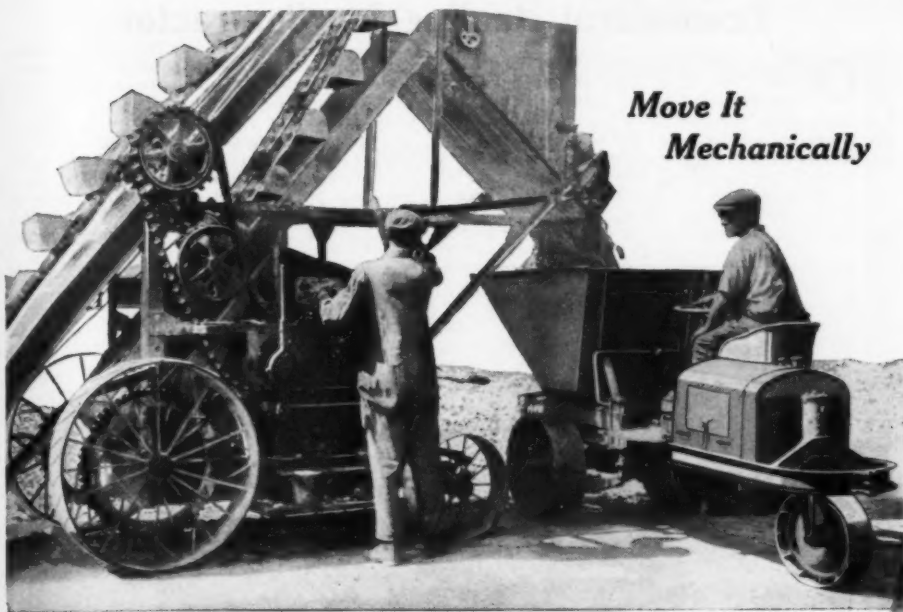
Because of its high-drum design, the boom on these pavers swings over 7 feet from the ground. This is absolutely impossible on any paver of low-drum design. With 7 feet clearance, men can work under this boom in perfect safety, as it will clear the heads of even the tallest men. This

high-swinging boom has other advantages besides its Safety First feature. It permits the use of a large, deep bucket, capable of handling an entire batch at once.

It is certain that accidents on road work could be reduced considerably if all manufacturers of pavers followed the lead of the one referred to above. By designing safety into their machines, they would aid the success of the contractor considerably, because, aside from the humanitarian viewpoint, accidents are costly and create dangerous delays. Contractors should look into the mechanical hazards of every machine they buy, and bring pressure upon the manufacturer to pay more attention to safety designing. It is a fact, too, that almost invariably the manufacturer who has given safety a place in his designing has also produced features of additional efficiency in his machinery.



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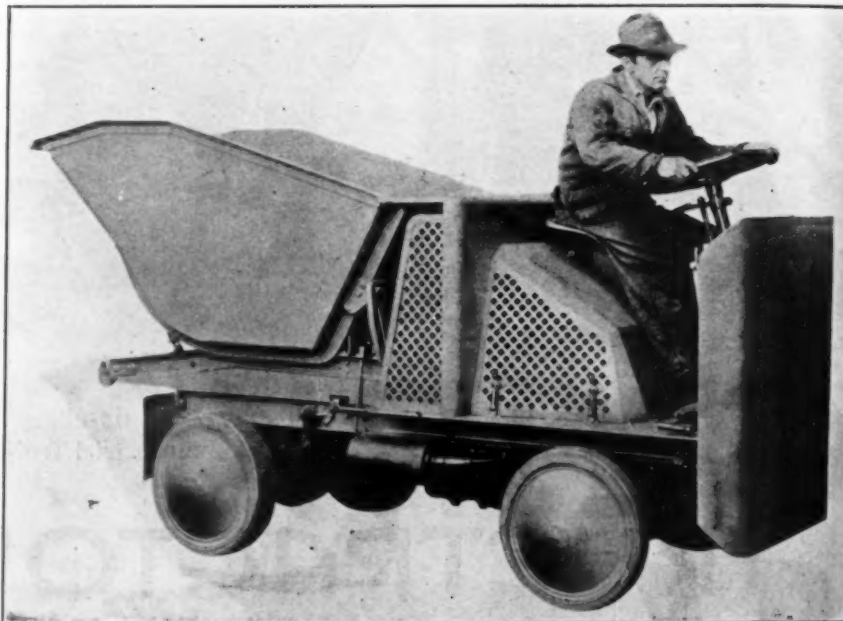


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Economical Hauling for Contractors

ONE of the difficulties encountered by contractors in all types of service is the economical usage of motor trucks. In many cases the average $2\frac{1}{2}$ to 5-ton truck is altogether too large for the service desired, in which case some light-weight truck may be substituted, but frequently breaks down because it is not sufficiently sturdy. The Barrett-Cravens Company, 160 Ann Street, Chicago, Ill., has placed on the market a new small tractor truck,

engine, is spring-mounted and enclosed in a heavy steel plate housing. Its location protects it from damage in collision and minimizes the effects of frame distortion. Power is applied to the rear wheels through a worm-drive rear axle of the fully enclosed type, the housing of which is constructed of a heavy one-piece electric steel casting. The drive is transmitted from the rear axle through the rear springs, giving a flexible cushioned action



THE POWEROX, A NEW SMALL UTILITY TRUCK

known as the "Powerox." This truck is equipped to carry a load of itself and will push or pull any load-carrying trucks or trailers. The tractor is of sturdy, compact construction, due to the novel arrangement of its various units, as shown in the illustration. The engine, clutch and transmission are from a unit power plant located at the front. A Renault type hood is used, upon which is located a spring-mounted driver's seat, thus giving the driver a clear view of the road and utilizing waste space.

The radiator is placed at the rear of the

when starting heavy loads. The springs are semi-elliptic and are flat under load.

The Powerox is designed and built for heavy duty on road, in factory or inter-plant work, for dock, freight terminal and warehouse work, and for light or medium construction work where a very small unit is needed. As a carrier, it will transport 3,000 pounds and as a tractor it will pull 40,000 pounds. It measures 4 x 8 feet overall, will travel in an ordinary aisle, and can be run through streets and in and out of buildings.

Gravel Survey Saved Iowa More Than \$100,000

Iowa gravel hunters working under the direction of the State Highway Commission, undoubtedly saved the state of Iowa on the construction work of 1920—to say nothing of additional savings in this and later years—more than \$100,000. Technically speaking, the gravel hunters were conducting a survey of the

road-building resources of the state. In this survey undeveloped gravel deposits were examined in 24 counties, and searches made for entirely new deposits. Through the efforts of the department, new gravel deposits were found and opened up which were used as the sole supply for a number of paving jobs.

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Motor Truck Versatile in Road Building

Ratio of 35 to 2 Represents Superior Capacity for Work of 5-Ton Truck Over Team of Horses on California Job

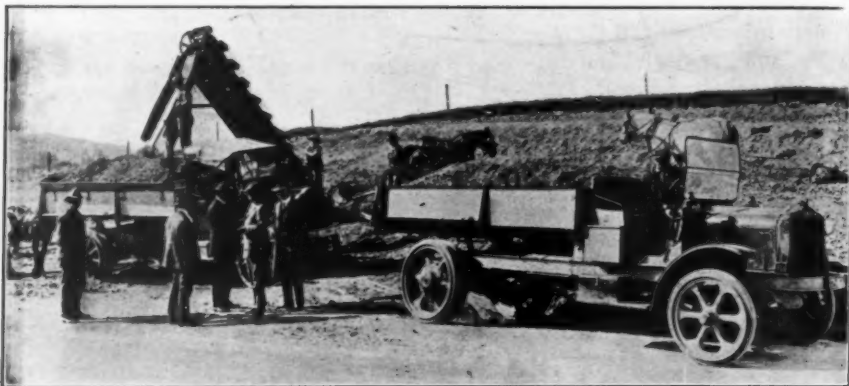
HAULING gravel from the pits to points along the road is just one phase of the work performed by the 5-ton White truck, owned by the county of San Luis Obispo, Calif., and another White of like capacity operated on the same job by John Guy, hauling contractor. When all phases are considered, the effect is to establish the versatility of the motor truck and to define sharply the contrast between old and new in hauling equipment and methods, for, struggling along with the powerful motor trucks, a few teams of horses are still retained. Their presence affords an un-

porting four yards to every 35 hauled and spread by a single motor truck.

"Besides, horses tire quickly. They also consume an enormous amount of feed. Motor trucks are tireless and require little attention, and their up-keep cost is negligible when the amount of work they accomplish is considered."

When not engaged in hauling gravel or spreading it along the road, the sturdy trucks are used in pulling road machinery or, equipped with 1,500-gallon tanks, in sprinkling the road.

The present method of excavating, loading,



WHITE 5-TON TRUCKS IN SAN LUIS OBISPO COUNTY, CALIF., ONE OWNED BY THE COUNTY, THE OTHER BY JOHN GUY, HAULING CONTRACTOR

escapable opportunity to measure literally in "horse-power" the endurance and capacity for work of the motor truck.

Reduced to figures, the exact superiority of the 5-ton truck over the horse would read something like this, according to Supervisor E. C. Loomis, in charge of road work in San Luis Obispo County:

"Each truck daily made six round trips, averaging 13 miles in length, carrying between $5\frac{1}{2}$ and 6 yards of gravel. Four horses, pulling a wagon and two yards of gravel, made two round trips a day, two teams thus trans-

porting and spreading gravel by motor truck is estimated to cost two-thirds less than in the days when horses were the sole equipment. Now, workmen plow up the tenacious gravel and scrape it within reach of the mechanical loader installed at the side of the gravel bank. A truck can be loaded and started on its way in ten minutes. Arrived at its destination, the truck distributes its load by means of the spreader which is part of its mechanism. During five months of 1920, 8 miles of gravel were laid in San Luis Obispo County.

Maintenance vs. New Roads

TO rebuild an 18-foot road with a modern pavement costs about \$40,000 a mile, for the top alone. The interest at 5 per cent is \$2,000 a year. With a life of 20 years \$2,000 a year must be provided for replacement. Maintenance costs \$500 per mile per year through any period of years. This makes the annual costs for new top \$4,500. The old sur-

face adequately maintained will give the same service at a great saving for several years to come. This is an aspect of road building that has not been popular with road engineers. It has been more fun to design and construct new roads than to devise proper maintenance methods.



A Highway for Giants

The road illustrated above was built during 1918 to carry traffic on which the heaviest load expected would rarely exceed 10 tons.

In 1921 we find this same road the pathway for giant trucks and trailers with loads of 20 to 30 tons. For months the average was 180 such loads per day in addition to a very heavy normal traffic, and today this road is in as perfect condition as when it was built.

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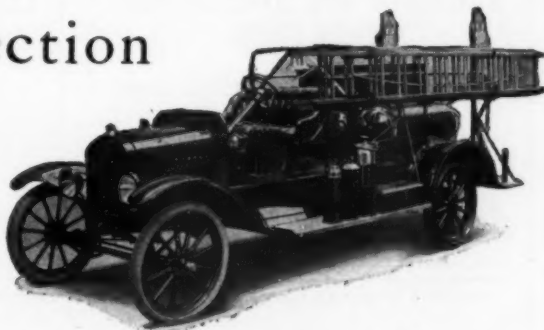
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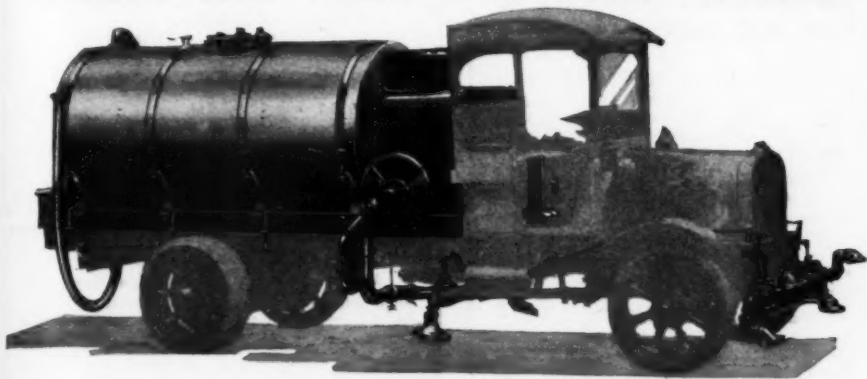
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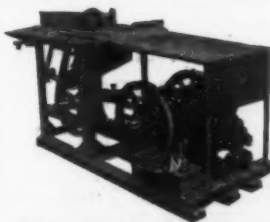
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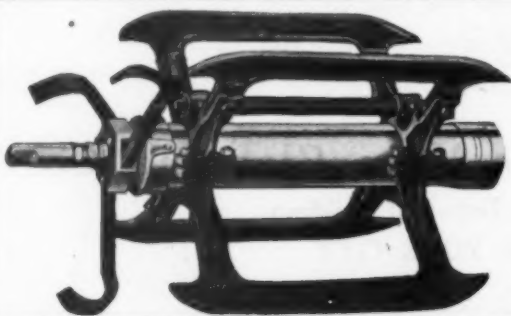
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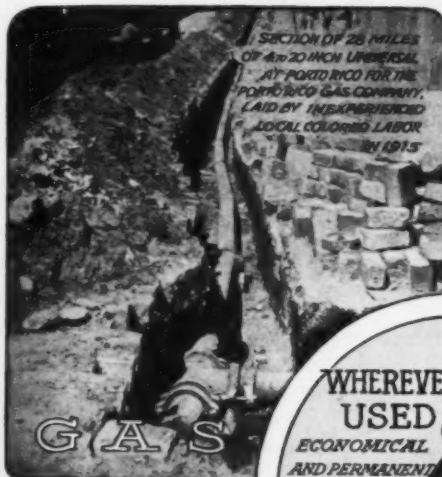
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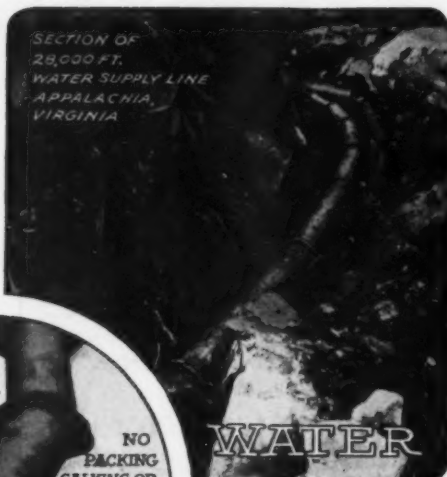
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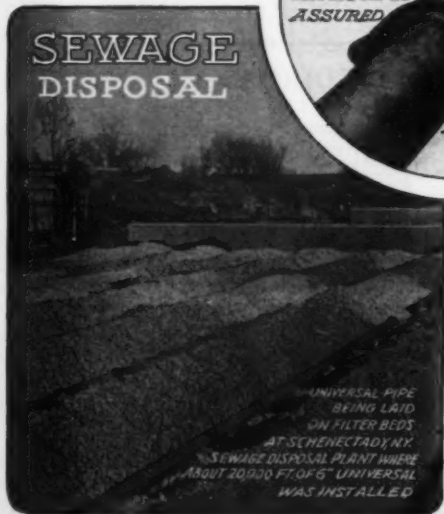
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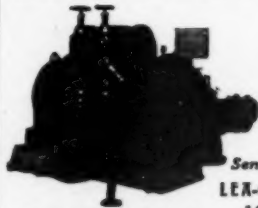
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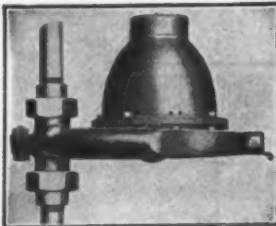
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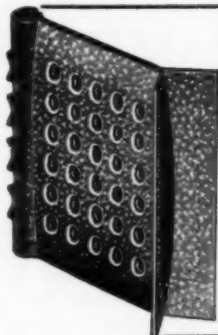
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We use only High Grade Carbon Steel and Hardwood in making Bausman Steel Swings and Settees. May we quote prices on your requirements? Send for our Catalogue No. 20.

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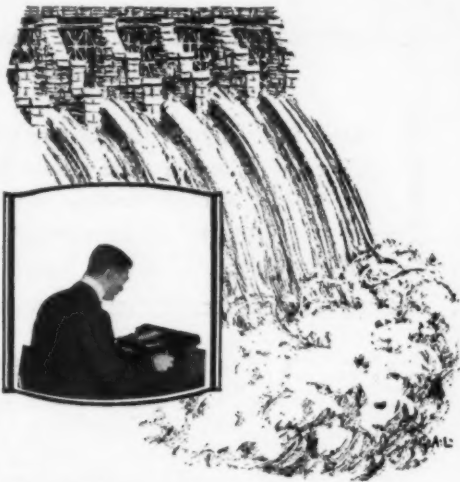
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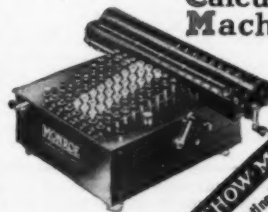
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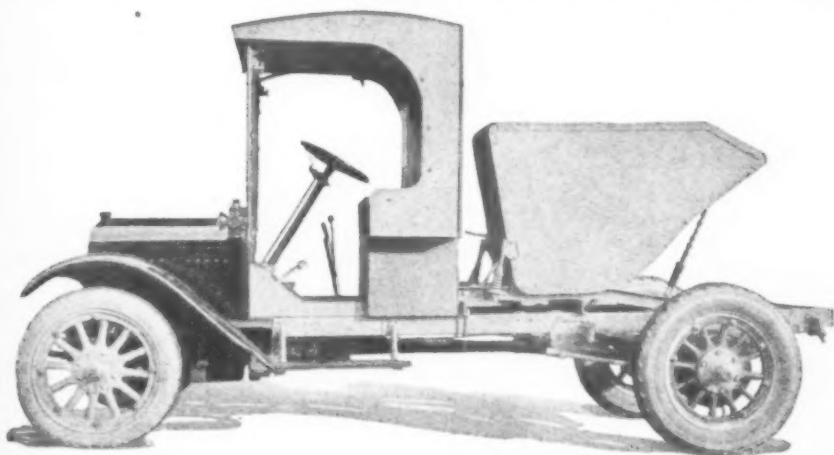
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Iroquois mixing plants turn out more work at less operating cost. They furnish 800 and 1250 square yards of 2" street asphalt topping a day.

Iroquois Portable Asphalt Mixing Plants are made in two types, with and without the power unit on the same frame as the mixer. The especial advantages of each type are described in our Bulletin No. 2A. Write for it at once.

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